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TECHNICAL REPORT M-70-11

MOBILITY EXERCISE A (MEXA) FIELD TEST PROGRAM

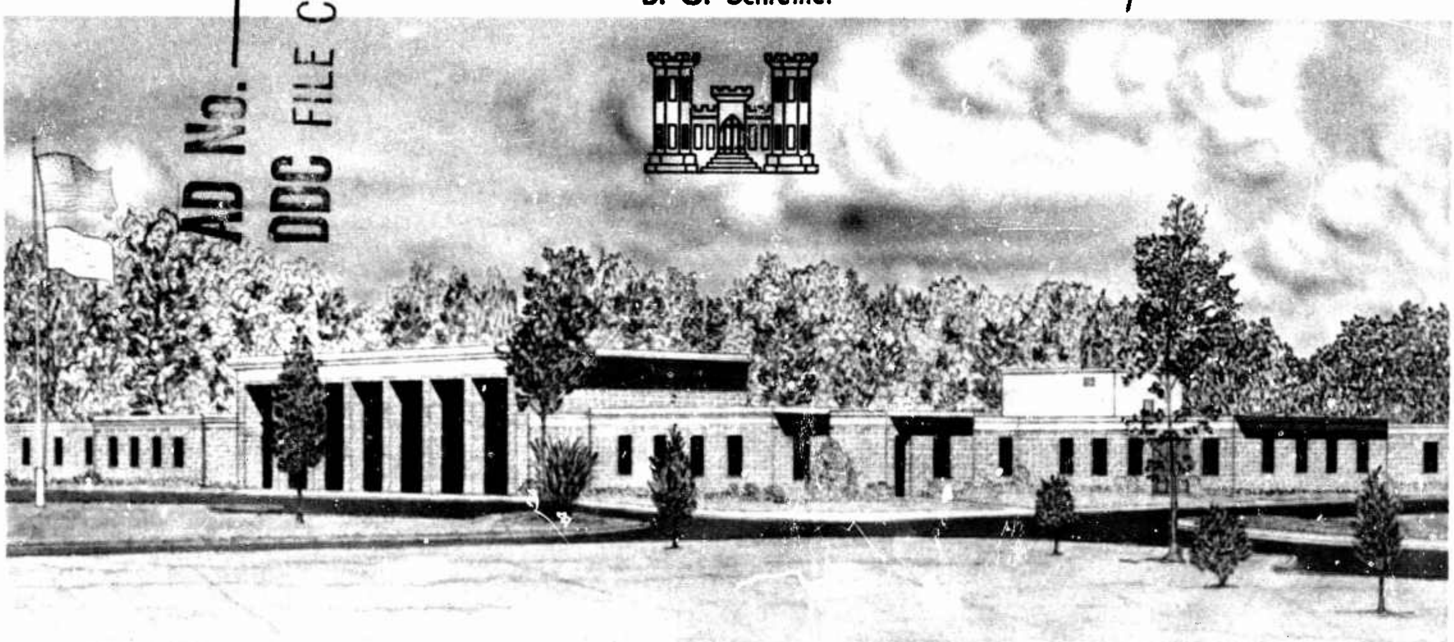
Report 2

PERFORMANCE OF MEXA AND THREE MILITARY VEHICLES IN SOFT SOIL

Volume I

by

B. G. Schreiner



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Conducted by U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi

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Sponsored by U. S. Army Materiel Command
Project Nos. 1T062109A131 and 1T062103A046-02

Conducted by U. S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi

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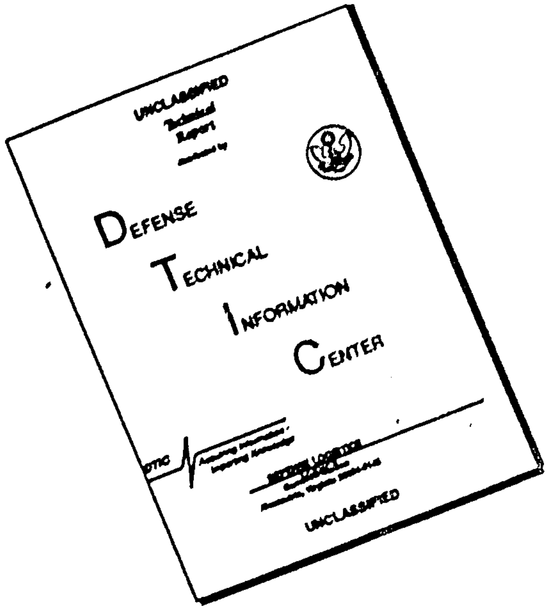

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FOREWORD

The study reported herein was performed by the U. S. Army Engineer Waterways Experiment Station (WES) as a part of the overall Mobility Exercise A (MEXA) program sponsored by the U. S. Army Materiel Command (AMC). Most of the funds for the MEXA program were provided under Project No. 1T062109A131, "Military Evaluation of Geographic Areas"; however, final analysis and report preparation were funded under Project No. 1T062103A046, "Trafficability and Mobility Research," Task 02, "Surface Mobility."

This study was conducted by personnel of the Vehicle Studies Branch under the general supervision of Mr. W. J. Turnbull, Technical Assistant for Soils and Environmental Engineering; Mr. W. G. Shockley, Chief, Mobility and Environmental (M&E) Division; Mr. S. J. Knight, Assistant Chief, M&E Division; Mr. A. A. Rula, Chief, Vehicle Studies Branch, and Mr. E. S. Rush, Chief, Soil-Vehicle Studies Section. Field tests were conducted by personnel of the Soil-Vehicle Studies Section under the direct supervision of Mr. B. G. Schreiner. Messrs. R. P. Smith, C. E. Green, W. E. Willoughby, and S. M. Hodge of the Soil-Vehicle Studies Section contributed to the reduction and analysis of test data. This report and Appendix A were prepared by Mr. Schreiner. Appendix B was written by Miss M. E. Smith and Mr. T. R. Patin of the Mobility Fundamentals Section, Mobility Research Branch, WES. Appendix C was written by Mr. T. F. Czako of the Land Locomotion Division, Mobility Systems Laboratory, U. S. Army Tank-Automotive Command.

This is Report 2 of a series entitled "Mobility Exercise A (MEXA) Field Test Program." The others are as follows: Report 1, "Summary"; Report 3, "Performance of MEXA and Three Military Vehicles in Lateral Obstacles"; Report 4, "Performance of MEXA and Three Military Vehicles in

Vertical Obstacles"; and Report 5, "Performance of MEXA and Three Military Vehicles in Selected Natural Terrains."

Directors of the WES during the conduct of this study and preparation of this report were COL John R. Oswalt, Jr., CE, COL Levi A. Brown, CE, and COL Ernest D. Peixotto, CE. Technical Directors were Messrs. J. B. Tiffany and F. R. Brown.

CONTENTS

CONVERSION FACTORS, BRITISH TO METRIC UNITS OF MEASUREMENT

British units of measurement used in this report can be converted to metric units as follows:

Multiply	By	To Obtain
inches	2.54	centimeters
feet	0.3048	meters
yards	0.9144	meters
miles (U.S. statute)	1.609344	kilometers
square inches	6.4516	square centimeters
square miles	2.58999	square kilometers
pounds	0.45359237	kilograms
pounds per square inch	0.070307	kilograms per square centimeter
pounds per cubic foot	16.0185	kilograms per cubic meter
miles per hour	1.609344	kilometers per hour
tons (2000 lb)	907.185	kilograms

SUMMARY

In the concept phase of Mobility Exercise A (MEXA) the principal purpose was to design vehicles capable of operating in remote areas of the world where extremely soft soils predominate, and to develop a program of tests for evaluating these vehicles in soft soils. As a result of the MEXA concept phase, two 2-1/2-ton wheeled and one 2-1/2-ton tracked vehicles were designed. The designs of the vehicle characteristics were in part derived from three existing systems that provide for predicting vehicle performance relative to soil strength. These systems were the U. S. Army Engineer Waterways Experiment Station (WES) soil trafficability system, the WES mobility numeric system, and the Land Locomotion Laboratory (LLL) soil value system.

After the MEXA vehicles were fabricated, a field test program was designed and conducted. A total of 328 tests were conducted on level clay soils at two sites near Vicksburg, Miss., and at eight sites near Fallon, Nev. The purpose of the test program in soft soil was to evaluate the performance of the three MEXA vehicles (MEXA 10x10, MEXA 8x8, and MEXA track) and three military vehicles (XM410E1, M35A2 (mod), and M113) on a range of soil strengths. Further purposes of this study were to compare the performances of the three MEXA vehicles with those of the three military vehicles and to compare the measured and predicted performances of the vehicles, using the three prediction systems from which the MEXA vehicles were designed. The measured and predicted performance comparisons are presented in Appendixes A, B, and C of Volume II.

The principal results of the MEXA field test program in soft soil were as follows:

a. Measured (experimental) vehicle cone indexes (VCI's) were established for the six test vehicles. They were:

Vehicle	Experimental VCI_{50}	Experimental VCI_{1t}
XM410E1	32	18
M35A2 (mod)	56	27
M113	29	15
MEXA 10x10	18	7
MEXA 8x8	23	11
MEXA track	21	7

Note: VCI_{50} = VCI for 50 passes.
VCI_{1t} = VCI for one pass (tentative).

The MEXA vehicles were superior to the military vehicles in terms of VCI_{1t} and VCI_{50}.

b. The best overall one-pass critical-layer criteria determined from field tests for the six vehicles were: the 0- to 6-in. layer was considered to be the normal critical layer unless the rating cone index (RCI) of the 6- to 12-in. layer was less than that of the 0- to 6-in. layer, in which case the 6- to 12-in. layer was considered to be the critical layer.

c. The soil strength parameter that showed best overall correlation with drawbar pull, motion resistance, speed, and maneuver results was the 0- to 6-in. RCI.

d. For the soil strengths tested, MEXA vehicle performance in terms of optimum drawbar pull coefficient was superior to that of the military vehicles, thus indicating a greater traction capacity.

e. Towed motion resistance coefficient was generally less for the MEXA wheeled vehicles than for the military vehicles. On soil below about 40 RCI the MEXA track motion resistance coefficient was lower than that of the military vehicles. Above about 40 RCI the MEXA track motion resistance coefficient was generally greater than that of the M113 and XM410E1, but less than that of the M35A2.

f. In terms of speed, MEXA vehicles do what they were designed to do, i.e. perform better on soft soils than military vehicles. However, on firm soil and on pavement, speed performance is less than that of the military vehicles. Performance curves indicate that the speeds of the six test vehicles at their respective VCI_1's appear to be about 2.5 mph.

g. For the range of soil strengths and speeds tested, speed appeared to be a more influential factor than soil strength in affecting the vehicles' ability to make a turn. The minimum soil strength required for maneuvering appears to be the same as VCI_{1t} for the XM410E1, M35A2 (mod), MEXA 8x8, MEXA 10x10, and MEXA track. As for the M113, additional test data are needed to determine the minimum soil strength required for maneuvering.

MOBILITY EXERCISE A (MEXA) FIELD TEST PROGRAM

PERFORMANCE OF MEXA AND THREE MILITARY VEHICLES IN SOFT SOIL

VOLUME I

PART I: INTRODUCTION

Background

1. In the initial effort (concept phase)[1] of the Mobility Exercise A (MEXA) program, the principal specific purposes were to design a number of vehicle test beds that could operate in remote areas of the world where extremely soft soils predominate, and to develop a program of tests for evaluating the performance of these vehicles in soft soil. As a result of the MEXA concept phase, two 2-1/2-ton* wheeled and one 2-1/2-ton tracked vehicles were designed.

2. The designs of the vehicle characteristics were in part derived from three existing systems that provide for predicting vehicle performance relative to soil strength. The U. S. Army Engineer Waterways Experiment Station (WES) soil trafficability system was used to determine the design characteristics necessary for the vehicles to make 50 successive straight-line passes on a soft soil. The WES mobility numeric system was used to design the characteristics required for the wheeled vehicles to make one pass on a soft soil. The Land Locomotion Laboratory (LLL) soil value system was employed in determining characteristics necessary for both the wheeled and tracked vehicles to make one pass on a soft soil.

3. After fabrication of the MEXA vehicles, shakedown tests were conducted in February 1967.[2] At the same time, a four-phase MEXA field test program was structured.[3] The field test program requirements were as follows. Phase I included the determination of the speed performances of the three MEXA vehicles and three military vehicles on soils of strengths

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* A table of factors for converting British units of measurement to metric units is presented on page vii.

ranging from so soft as to cause immobilization to and including a hard-surfaced road. Phase II included the establishment of essential soil strength-vehicle performance relations. Phase III included the updating of some of the terrain-vehicle relations required for a cross-country speed prediction model. Phase IV included an evaluation of the accuracy of the updated cross-country speed model in predicting performance from data derived from air-photo interpretation as opposed to data obtained from field measurements. The tests reported herein were conducted under the requirements of Phases I and II.

Purpose

4. The general purpose of this test program was to evaluate the performance of the three MEXA vehicles and the three military vehicles (the XM410E1, the M35A2 (mod), and the M113) on a range of soil strengths. The specific purposes of field tests were to determine (a) the minimum soil strengths, in terms of vehicle cone index (VCI), on which the test vehicles could make one pass and 50 passes, (b) drawbar pull-soil strength relations, (c) towed motion resistance-soil strength relations, (d) maximum speed-soil strength relations, and (e) maneuverability-soil strength relations. It was also the purpose of this study to compare the performances of the three MEXA vehicles with those of the three military vehicles, and to compare the measured and the predicted performances of the vehicles, using the WES soil trafficability, the WES mobility numeric, and the LLL soil value systems. The latter comparisons are presented in Appendixes A, B, and C, respectively, Volume II.

Scope

5. The overall soft soil test program was divided into preliminary and comprehensive test programs. The preliminary program consisted of some of the tests to determine VCI for one pass and 50 passes. This program was conducted from late April to early September 1967 at two sites near Vicksburg, Miss. The comprehensive program included the completion of the VCI

tests and the rest of the tests required to satisfy the purpose of the study. Tests were conducted at eight sites near Fallon, Nev., from early October to early November 1967 and from mid-May to early June 1968. Tests were also conducted at one site near Vicksburg during September 1968. Testing was limited to sites containing clay soil with relatively smooth surfaces. Types of tests, vehicles tested, and number of tests conducted are given in the following tabulation.

Type of Test	No. of Tests Conducted with Each Vehicle MEXA 10x10	MEXA 8x8	MEXA Track	XM410E1	M35A2 (mod)	M113	Total
VCI	18	14	13	12	14	15	86
Drawbar pull	17	10	14	7	6	9	63
Towed motion resistance	7	6	7	5	4	5	34
Speed	8	12	7	5	6	6	44
Maneuver	20	16	21	20	8	16	101
Total	70	58	62	49	38	51	328

Soil measurements and vehicle performance data collected during the field test program were tabulated and analyzed. Analyses of data presented herein included the development of the soil-vehicle relations outlined in the preceding paragraph.

Definitions

6. Certain special terms used in this report are defined below.

Soil terms

Unified Soil Classification System (USCS).[4] A soil classification system based on identification of soils according to their textural and plastic qualities and on their grouping with respect to engineering behavior.

Critical layer. The layer of soil that is most pertinent to establishing relations between soil strength and vehicle performance. For 50-pass performance in fine-grained soils and sands with fines, poorly drained,

it is usually the 6- to 12-in. layer; however, it may vary with weight of vehicle and with soil strength profile. For one-pass performance, it is usually some shallower layer.

Soil strength terms

Cone index (CI). An index of the shearing resistance of a medium obtained with a cone penetrometer (shown in fig. 1). The value represents the resistance of the medium to penetration of a 30-deg cone of 0.5-sq-in. base or projected area. The number, although usually considered dimensionless in trafficability studies, actually denotes pounds of force on the handle divided by the area of the cone base in square inches.

Fig. 1. Cone penetrometer

Remolding index (RI). A ratio that expresses the proportion of original strength of a medium that will remain under a moving vehicle. The ratio is determined from cone index measurements made before and after remolding a 6-in.-long sample using the equipment shown in fig. 2. The test sample is obtained with a trafficability sampler (shown in fig. 3).

Rating cone index (RCI). The product of the measured CI and the RI of the same layer.

Shear stress. The greatest shear stress recorded when torque is applied to the sheargraph head during initial soil failure for a particular normal stress maintained on the sheargraph handle. (The sheargraph, shown in fig. 4, is a hand-operated instrument utilizing a coiled spring for measuring torque and load.)

Vehicle terms

Immobilization. The inability of a self-propelled vehicle to move forward or backward.

Pass. One trip of the vehicle over a test course.

Multiple passes. More than one pass of the vehicle in the same path over the test course.

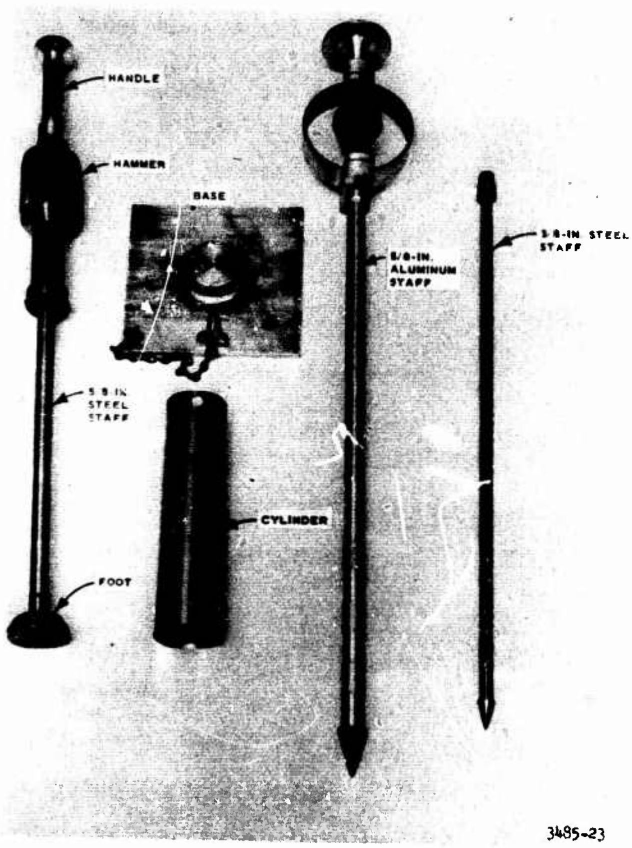


Fig. 2. Remolding equipment

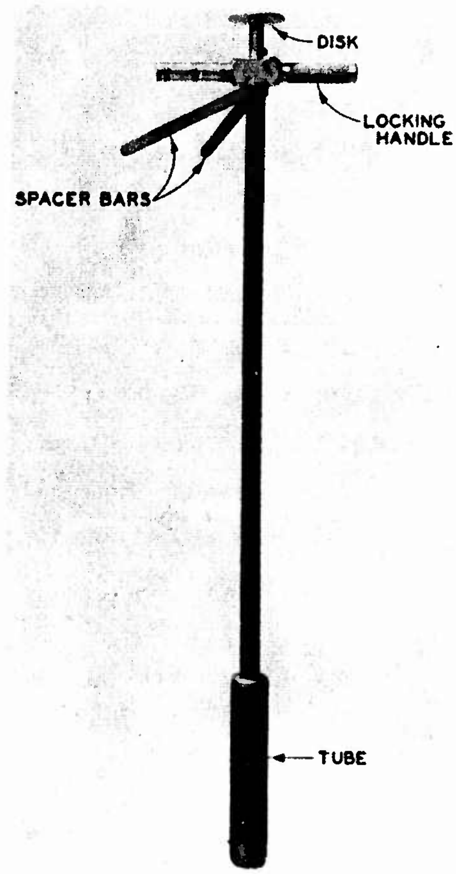


Fig. 3. Trafficability sampler

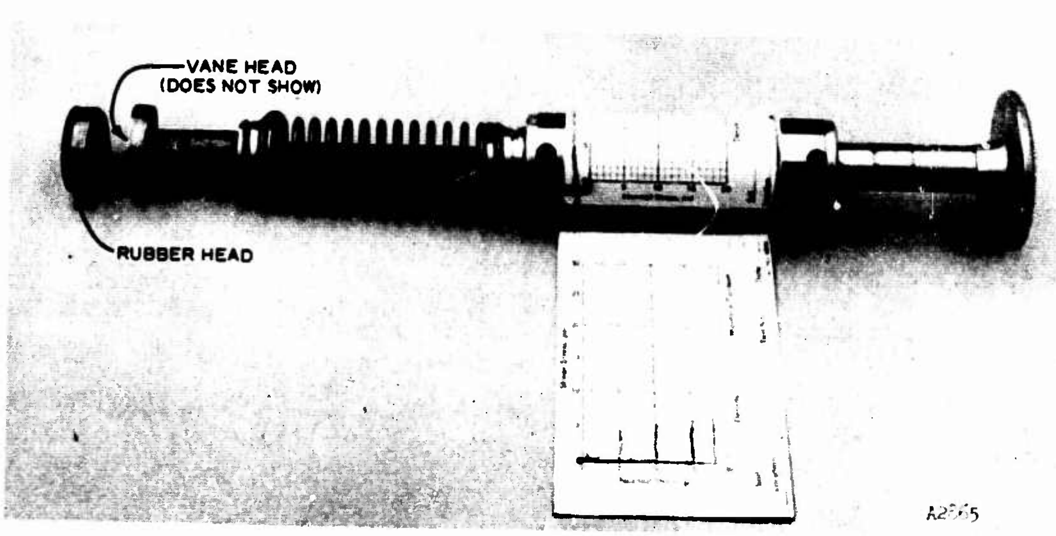


Fig. 4. Cohron sheargraph

Mobility index (MI). A dimensionless number that results from a consideration of certain vehicle characteristics (see Appendix A, Addendum A1, for formulas).

Vehicle cone index (VCI). The minimum rating cone index (RCI) that will permit a vehicle to complete a specified number of passes, usually one pass and 50 passes.

VCI_{50} measured. An experimental determination of the minimum RCI of the critical layer required for a vehicle to complete 50 passes. The critical layer for most vehicles is usually the 6- to 12-in. layer below the surface.

$VCI_1(50)$ measured. An experimental determination of the minimum RCI of the critical layer required for a vehicle to complete one pass. The critical layer is the same as that for VCI_{50}, i.e. usually the 6- to 12-in. layer.

VCI_{1t} measured (tentative). An experimental determination of the minimum RCI of the critical layer required for a vehicle to complete one pass. The critical layer for most vehicles is usually the 0- to 6-in. layer.

Maximum drawbar pull (maximum towing force). The maximum amount of sustained towing force a self-propelled vehicle can produce at its drawbar under given test conditions.

Optimum drawbar pull. The towing force that a vehicle produces at its maximum work output.

Work output index.

$$\text{Work output index} = \frac{\text{drawbar pull}}{\text{vehicle weight}} \times \frac{\text{distance vehicle traveled}}{\text{distance wheel or track traveled}}$$

Towed motion resistance. The force required to tow a given vehicle in neutral gear under given test conditions.

Ackerman steering angle. The acute angle between the left front wheel and the longitudinal axis of the vehicle.

Articulated steering angle. The acute angle between the longitudinal axes of the front and rear vehicle units.

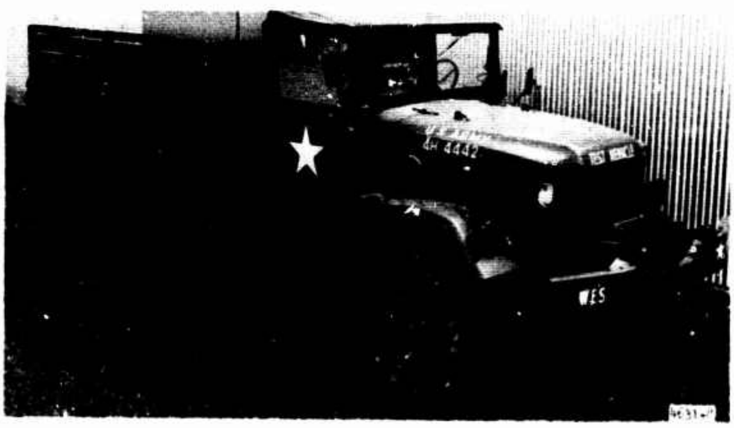
Slip. The percentage of track or wheel movement ineffective in advancing a vehicle forward.

PART II: FIELD TEST PROGRAM

Test Vehicles

7. The wheeled military vehicles tested were the XM410E1 and the M35A2 (mod) and the tracked vehicle was the M113 (see fig. 5). The MEXA

a. XM410E1



b. M35A2 (mod)

c. M113

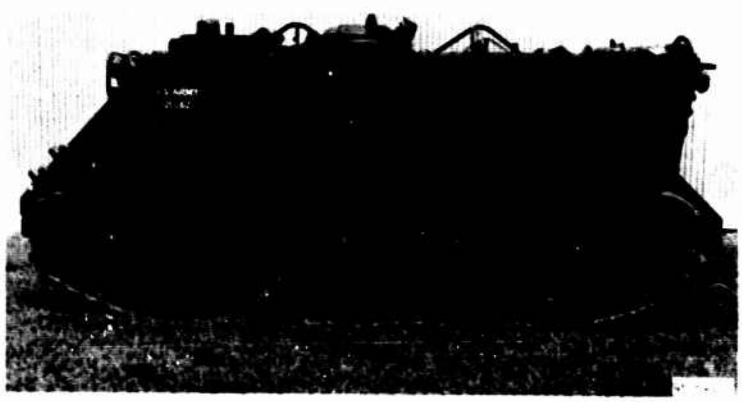
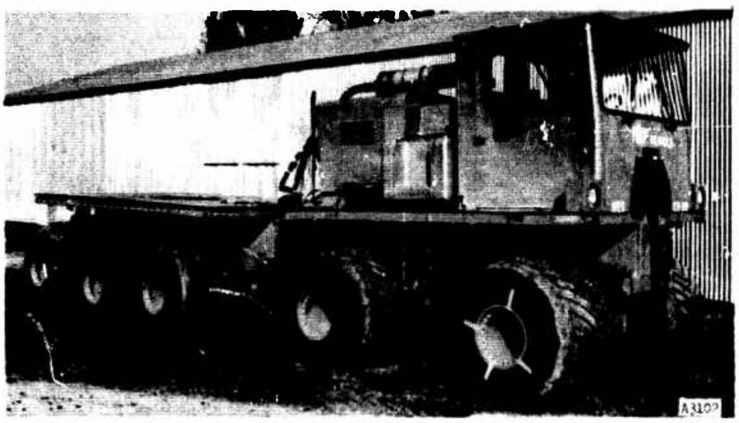


Fig. 5. Military vehicles used in test program

vehicles tested were the MEXA 10x10 and MEXA 8x8 (both wheeled) and the MEXA track (see fig. 6). The modifications to the M35A2 consisted of changing the tires to 11:00x20 NDCC and changing from dual rear wheels to single rear wheels. Pertinent data for the six vehicles are given in



a. MEXA 10x10

b. MEXA 8x8

c. MEXA track

Fig. 6. MEXA vehicles used in test program

table 1. A more detailed list of vehicle characteristics is given in Report 1 of this series.[5]

8. As stated previously a preliminary test program was conducted. The purpose of this program was to shake down the MEXA vehicles and to obtain a quick evaluation of their VCI's and those of the M113 and the XM410E1. These preliminary tests included 29 tests at the WES reservation and 5 tests with the XM410E1 at Chotard Lake. For these tests only, approximate cross-country payloads were placed on the XM410E1 and M113 and the tires of the XM410E1 were inflated to recommended cross-country inflation pressure. After completion of the preliminary tests, adjustments were made to certain vehicle characteristics to satisfy the requirements of the comprehensive test program as follows. (a) The vehicles' payloads were adjusted to that specified for cross-country or combat operation. The payload of the XM410E1 was reduced from 7000 to 5000 lb and the payload of the M113 was reduced from 5600 to 4000 lb. (b) Inflation pressure for each tire was adjusted to yield 25 percent deflection for the XM410E1 and M35A2 (mod) and 20 percent deflection for the MEXA 10x10 and 8x8. (The changes in weight and tire pressure were taken into consideration in the analyses of VCI tests.)

Selection, Location, and Description of Test Sites

9. Primary requirements in the selection of the test sites were that the sites (a) be of the same general soil type (clay), (b) be large enough to accommodate several tests, and (c) consist of soil having the range of strength necessary to evaluate the performance of the test vehicles. Also, the estimated cost of testing at a site had to be compatible with the funds available. Several areas were considered. These areas were reconnoitered and after an evaluation of the reconnaissance information, sites that best met the test requirements were selected. It will be recalled that the final selections were two sites at Vicksburg, Miss., and eight near Fallon, Nev.

Vicksburg sites

10. <u>WES Reservation.</u> This site is adjacent to a small upland stream

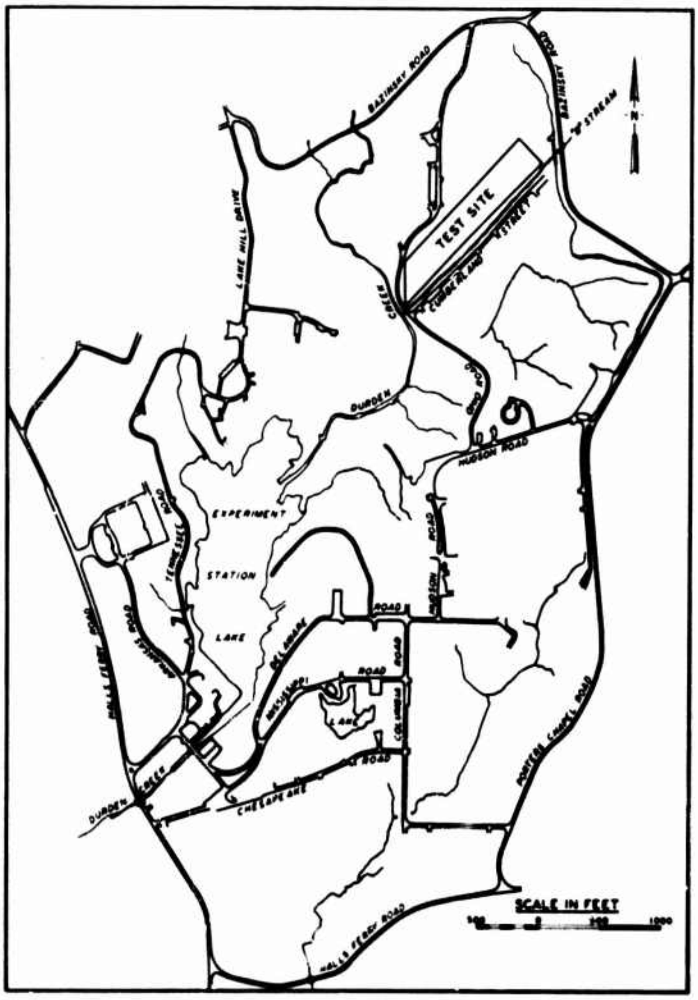


Fig. 7. Location of WES Reservation test site

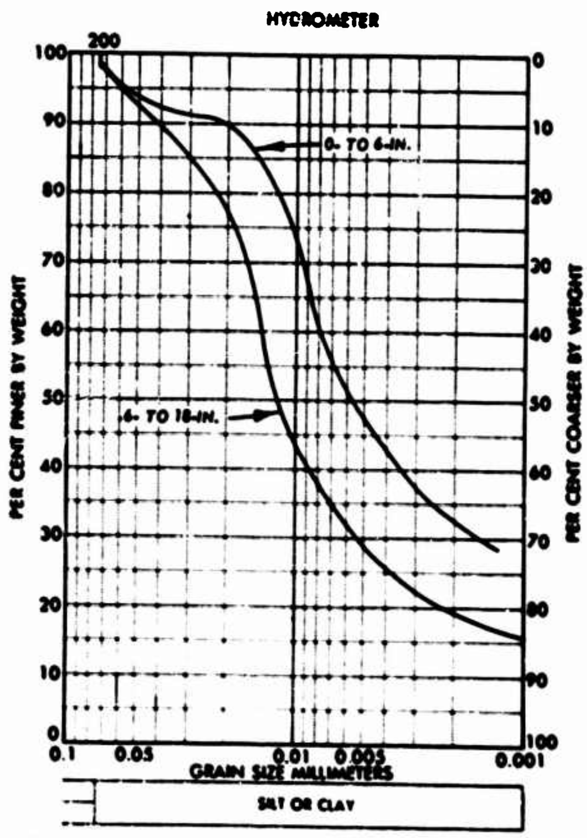
(B Stream) that flows through the WES Reservation (figs. 7 and 8). The site was a soft, relatively level, recent hydraulic fill that varied from 3 to 6 ft in depth; the material for the fill had been pumped from the nearby WES lake. The fill soil classified as fat clay (CH) in the 0- to 6-in. layer and as lean clay (CL) in the 6- to 18-in. layer according to the USCS (fig. 9). Most of the vegetation (tall weeds) was removed before testing.

11. Chotard Lake. This test site is on the south bank of Chotard Lake approximately 18 miles northwest of Vicksburg (fig. 10). The water level of the lake rises and falls with that of the Mississippi River, which feeds the lake. At the time of testing the river was low, and a flat expanse of lakeshore was exposed and accessible. The shoreline for a distance of about 400 ft from the lake was practically devoid of vegetation. Inland from this open area was an area that extended for about 300 yd on which willow trees with trunk diameters ranging from [illegible] to 10 in. were growing. Views of the site are shown in fig. 11. Tests were conducted in both the open and wooded areas. The soil to a depth of 18 in. was classified as fat clay (CH), according to the USCS (fig. 12).

Fallon sites

12. Carson Sink. Carson Sink is a large, flat, barren playa,

Fig. 8. WES Reservation test site



ELEV OR DEPTH	CLASSIFICATION	LL	PL	PI
0- TO 6-IN.	CH	66	26	40
6- TO 18-IN.	CL	49	23	26

Fig. 9. Soil gradation curves and classification data, WES Reservation test site

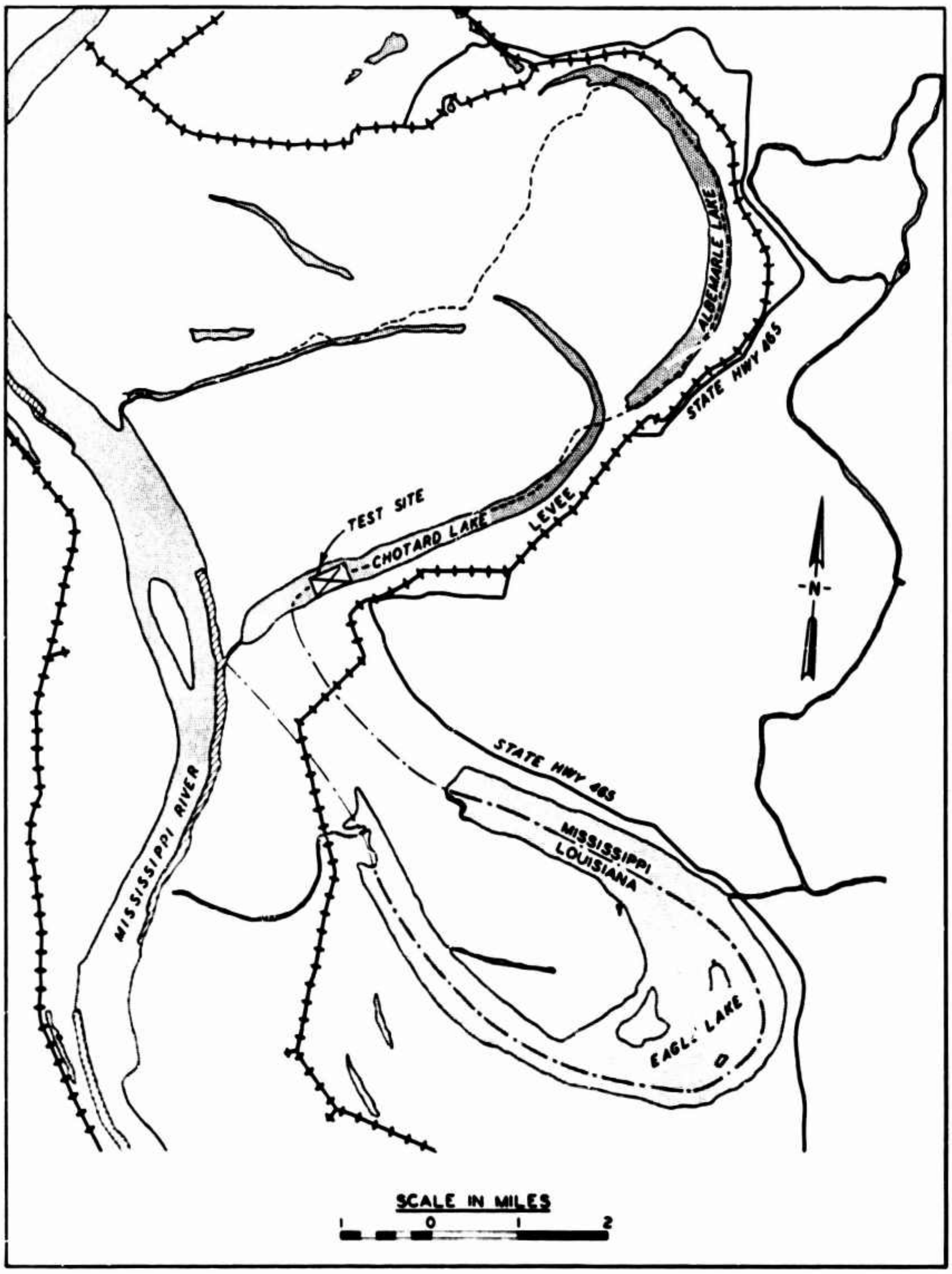
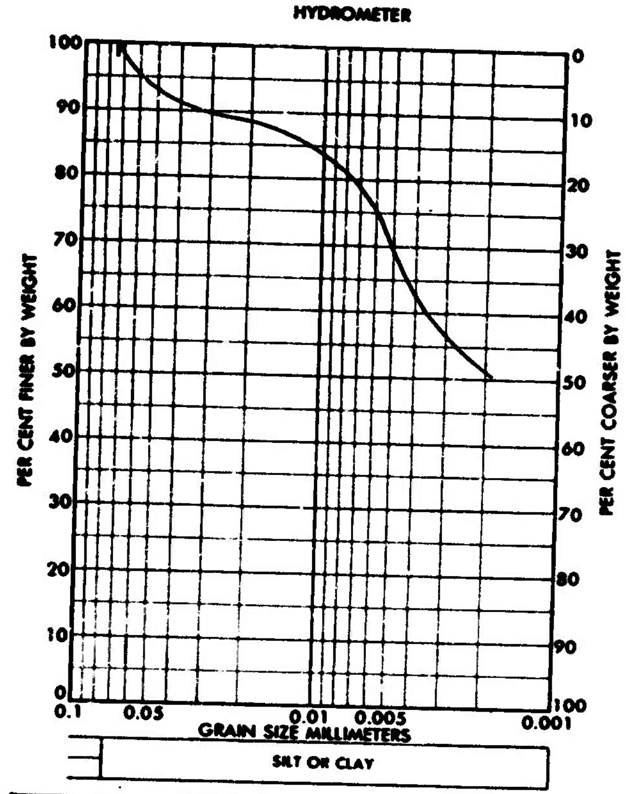


Fig. 10. Location of Chotard Lake test site

a. Open area

b. Wooded area

Fig. 11. Chotard Lake test site



ELEV OR DEPTH	CLASSIFICATION	LL	PL	PI
0- TO 18-IN.	FAT CLAY (CH)	87-92	32-34	55-58

Fig. 12. Soil gradation curve and classification data, Chotard Lake test site

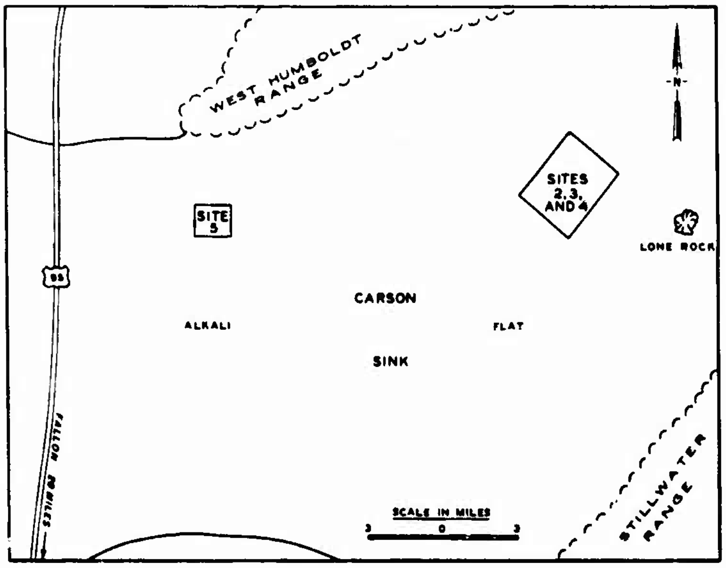


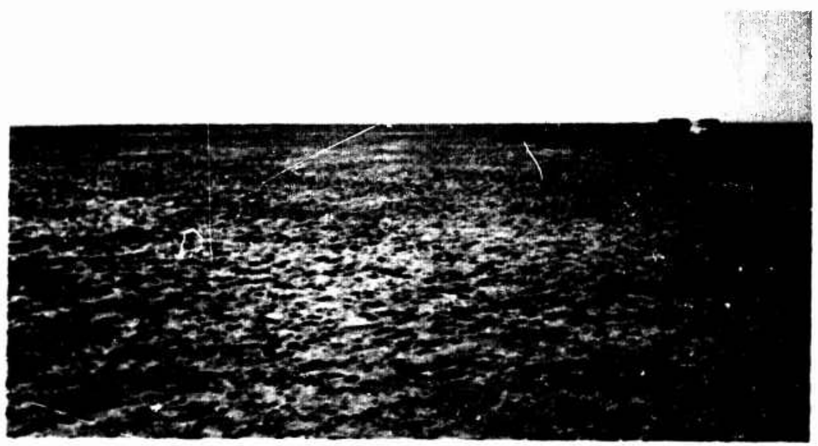
Fig. 13. Location of Carson Sink test sites

covering about 400 square miles. It is located about 20 miles northeast of Fallon (see fig. 13). Carson Sink serves from time to time as a sump for water diverted from the Carson River to relieve flooding of adjacent farmlands and of nearby Fallon National Wildlife Refuge. At the time of testing, most of the ground at Carson Sink was firm and free of surface water. After a thorough investigation of the playa, four sites (see fig. 14), each having a different soil strength, were established and tested. The soil of sites 2, 3, and 4 classified as lean clay (CL) in the 0- to 5-in. layer and as fat clay (CH) in the 5- to 18-in. layer. The soil of site 5 classified as a fat clay (CH) in the 0- to 18-in. layer. (Classifications were in accordance with the USCS.) Soil gradation curves representative of the test sites at Carson Sink are shown in fig. 15.

13. Four Mile Flat. Four Mile Flat is a barren playa about 20 square miles in area. It is about 20 miles southeast of Fallon (see fig. 16). The western half of the playa was firm and at the time of testing was crisscrossed by numerous drainageways that were 3 to 6 ft deep. In the western half, one site (site 9) was established on a flat between two drainageways. Between the western half (alkali flat) and the eastern half (dry lake) of the playa, a relatively sharp drop in elevation (about 8 ft) occurs. The eastern half serves as a sump for rainwater draining from the Salt Wells Basin and the surrounding mountains. Three test sites (6, 7,

a. Site 2

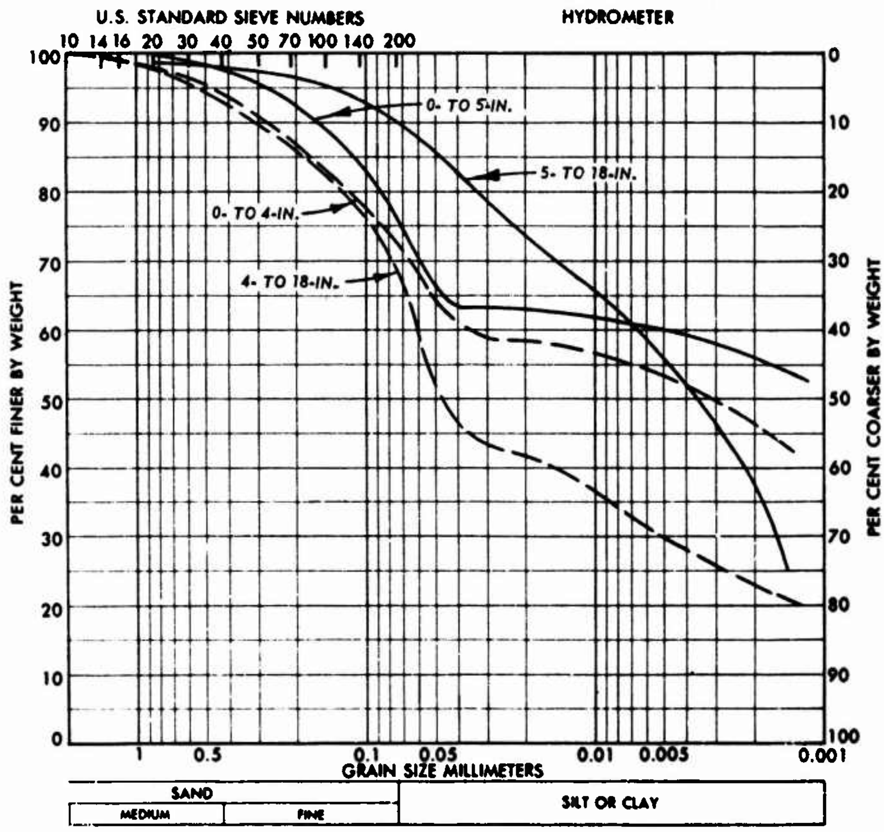
b. Site 3



c. Site 4

d. Site 5

Fig. 14. Carson Sink test sites 2-5



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	LL	PL	PI
SITES 2, 3, AND 4	0- TO 5-IN.	CL	45	18	27
	5- TO 18-IN.	CH	69	24	45
SITE 5	0- TO 4-IN.	CH	83	21	42
	4- TO 18-IN.	CH	73	24	49

Fig. 15. Soil gradation curves and classification data, Carson Sink test sites

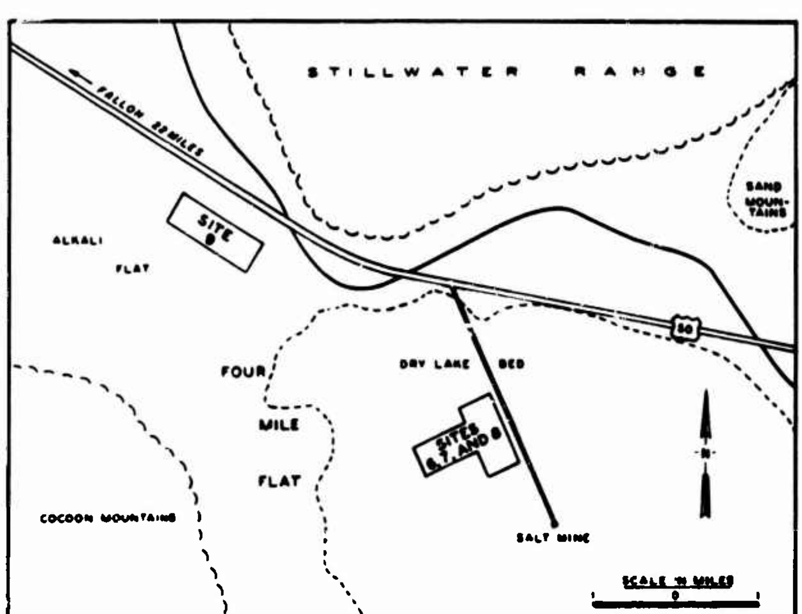
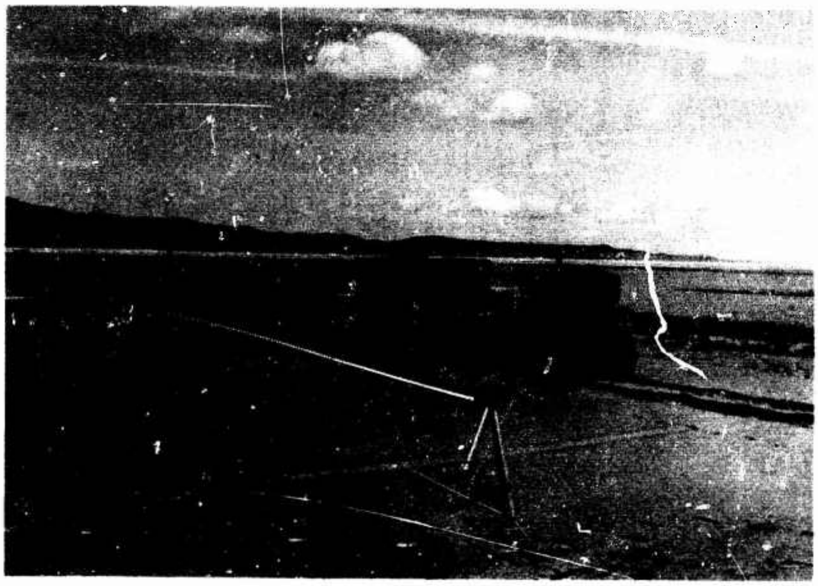
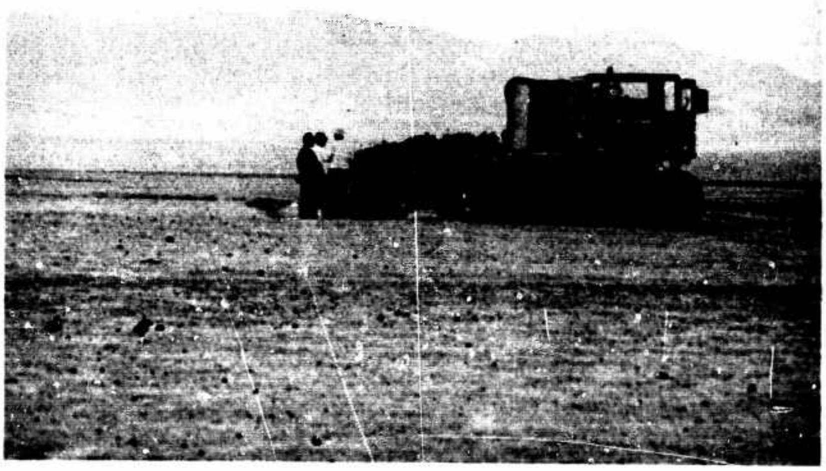


Fig. 16. Location of Four Mile Flat test sites

and 8), each of different soil strength, were established in the eastern half of the playa. At the time of testing, the sites were generally flat, soft, and free of surface water. The soil classified as a fat clay (CH) in the 0- to 18-in. layer. There was a hardpan composed of sand and salt at a depth of 26 to 30 in. that was too firm to penetrate with a hand probe. Views of the sites are shown in fig. 17. A soil gradation curve that is representative of the sites is shown in fig. 18.

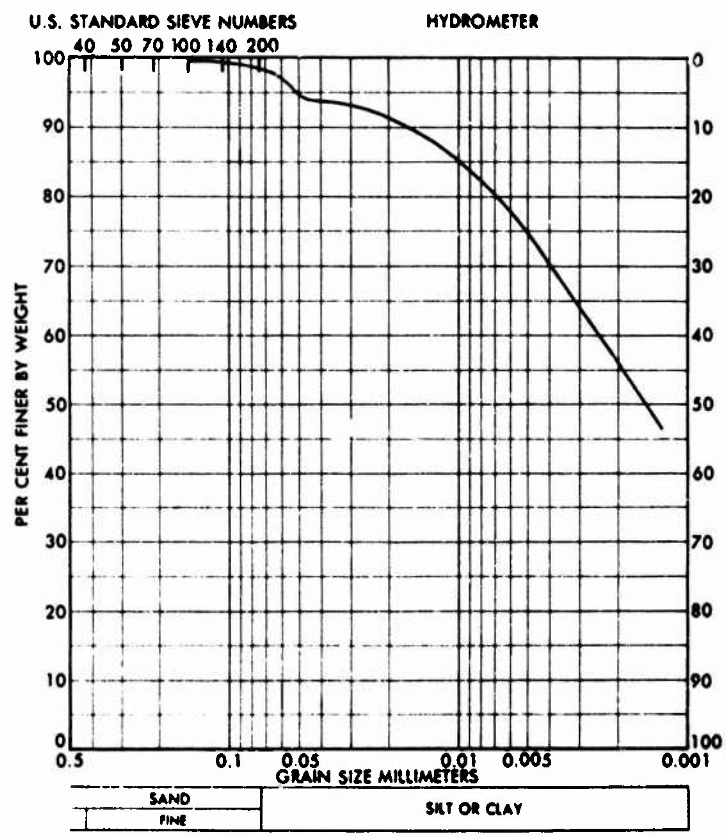
a. Sites 6, 7, and 8





b. Site 9

Fig. 17. Four Mile Flat test sites 6-9



ELEV OR DEPTH	CLASSIFICATION	LL	PL	PI
0- TO 18-IN.	CH	56	25	31

Fig. 18. Soil gradation curve and classification data, Four Mile Flat site 6

Test Procedures and Data Collected

CI determination

14. Before traffic began, a 100-ft-long test lane was staked out and cone index of the soil was measured generally at the surface and at 3-in. vertical increments to a depth of 18 in., and at 24- and 30-in. depths. These measurements were usually made at 10-ft horizontal intervals along the expected paths of the left and right wheels or tracks of the vehicle. In some tests, where immobilization was anticipated on the first or second pass, initial cone index readings were actually made in the undisturbed area along both sides of the vehicle after it had become immobilized.

Twenty sets of cone index readings usually were made for each test. In most tests, remolding indexes were measured at two locations beside the test lane (generally at the station where the lowest cone index was recorded) for the 0- to 6-in., 6- to 12-in., and 12- to 18-in. depths. At the remolding index stations, surface shear measurements were made with the sheargraph vane and rubber shear heads. Moisture content and density samples were taken from the surface to a depth of 18 in. at each remolding index station. Representative bulk soil samples were obtained from the surface to a depth of 18 in. for field and laboratory identification. During and after traffic, cone index (at the same horizontal and vertical intervals as those for before-traffic measurements) and rut depths were measured. Observations of the soil and vehicle behavior were recorded during each test.

15. Self-propelled tests were conducted to determine the required minimum soil strength for each test vehicle to complete one pass and 50 passes. In these tests, each vehicle was operated in its lowest gear at a track or wheel speed of approximately 2 mph (except on maximum speed passes), and was driven back and forth in 100-ft-long straight-line test lanes until it became immobilized or completed 50 passes.

Drawbar pull-slip and -speed tests

16. Before each drawbar pull test, a test lane large enough to accommodate the test was selected and staked, and a sufficient number of cone index measurements were made to determine that the soil was of the desired strength. Cone index, remolding index, and shear stress were measured, and soil samples for field and laboratory identification and moisture content and density determinations were collected in the same manner as that for the VCI tests.

17. Drawbar pull-slip tests were performed by attaching a load cell to a 70-ft-long cable extending from the rear of each test vehicle to the front of a load vehicle. After the test vehicle (operating in its lowest gear) had reached optimum engine rpm (approximately 2 mph) the load vehicle driver increased the load in several stages (by applying the brakes of the load vehicle gradually) from "no load-no slip" to either "high load-high slip" or "power limited" condition (test vehicle did not have sufficient

power to develop 100 percent slip). At all times the test vehicle driver maintained optimum engine rpm. Measurements were made in this manner until a sufficient number of load and slip combinations were recorded to develop a drawbar pull-slip curve.

18. Drawbar pull-speed tests were performed in the same manner as that for drawbar pull-slip tests with one exception: tests were performed at maximum engine rpm in each gear necessary to develop the drawbar pull-speed performance of each vehicle.

Towed motion resistance tests

19. Towed motion resistance tests were conducted in conjunction with drawbar pull tests. With its engine running and transmission disengaged, each test vehicle was positioned so as to straddle one of the ruts developed during the drawbar pull-slip test. The test vehicle was then towed at approximately 2 mph while a continuous record of motion resistance (towed pull) was made.

Speed tests

20. Before each test, a test lane of uniform soil strength was selected in the same manner as that for the drawbar pull tests. Additional before- and after-traffic soil strength data were collected in the same manner as that for the VCI tests.

21. Each test vehicle began a self-propelled, straight-line test from a standstill (zero speed) condition in its lowest gear and at full throttle and continued through each gear until maximum speed was reached. Then the power train was disengaged, and the vehicle was allowed to roll to a stop.

Maneuver tests

22. Before testing began, a section of uniform soil strength large enough to accommodate tests at three different vehicle speeds was staked out. After the test runs were completed, the following data were collected: a planimetric map showing vehicle position markers and the path of turn relative to the approach lane; rut depths; cone index readings in the undisturbed area adjacent to the path taken by the vehicle; cone index readings in the ruts; and sheargraph readings, both at the surface and at the depth of rut. Remolding index and moisture content-density samples were

collected in the same manner as that for the VCI tests.

23. A straight-line approach lane, about 300 ft long, was staked out to establish a base line for each test. The test vehicle driver aligned the vehicle in the approach lane and accelerated to the desired speed. Then a ground position marker and data recorder were activated. When the vehicle reached a predetermined spot in the approach lane, the driver turned the vehicle as fast as he could until the maximum steering angle was reached, and at the same time the driver attempted to keep a constant vehicle speed. After maintaining the maximum steering angle and near constant speed through an approximately 180-deg turn, the driver shifted the power train into neutral and allowed the vehicle to roll to a stop. In addition, at most test sites, a test was conducted in which the vehicles were steered into the tightest turn possible while maintaining a speed of approximately 1 mph. The vehicles continued in this manner through a 360-deg turn.

Vehicle response measurements

24. Each test vehicle was instrumented to provide a continuous record of the desired response measurements during testing. These responses were recorded by a system that included a 36-channel, direct-print oscillograph and two 4-channel amplifier units. The system, together with an alternating current power supply, was installed on the bed of each test vehicle. A detailed description of the instrumentation system is given in Report 1 of this series.[5] The following tabulation shows the type of test and the measurements used in the analysis.

Type of Test	Measurements Made
Drawbar pull	Drawbar pull; drive-line torque; distance traveled by vehicle; distance traveled by wheel or track; time; vehicle speed
Towed motion resistance	Towed pull; distance traveled by vehicle; distance traveled by wheel or track; time
Speed	Drive-line torque; distance traveled by vehicle; distance traveled by wheel or track; steering angle; vehicle speed; time

(Continued)

Type of Test	Measurements Made
Maneuver	Drive-line torque; distance traveled by wheel or track; event marks coinciding with ground position markers; steering angle; time; vehicle speed (these measurements were excluded on 360-deg turn test, see paragraph 23)

PART III: DATA ANALYSES

25. The test data were analyzed to determine the relations between soil strength measurements and certain vehicle performance parameters. The relations to be determined were: (a) number of passes completed by vehicle versus soil strength, from which VCI's for one pass and 50 passes were determined, (b) vehicle speed versus drawbar pull, (c) drawbar pull versus slip, (d) drawbar pull versus soil strength, (e) towed motion resistance versus soil strength, (f) vehicle speed versus time (acceleration and deceleration), (g) maximum speed versus soil strength, (h) turning radius versus speed, (i) force versus steering angle, and (j) force versus soil strength. The data analyses are presented in the following paragraphs, together with a discussion of the performance of the MEXA vehicles' articulated steering and inching systems in soft soil.

VCI Tests

26. Eighty-six VCI tests were conducted at sites near Vicksburg, Miss., and Fallon, Nev. A summary of soil data and test results is given in table 2. The relations developed from these test results are discussed in the following paragraphs.

Determination of VCI for 50 passes

27. Previous trafficability studies in fine-grained soils have shown that the performance of most wheeled and tracked vehicles in terms of go-no go for 50 passes can be related to soil strength in terms of RCI. The RCI that is just adequate to support 50-pass traffic of a particular vehicle is designated as the 50-pass vehicle cone index (VCI_{50}). Furthermore, test results have shown that there is a 6-in.-thick soil layer whose RCI best relates to vehicle performance. This layer is designated as the critical layer. The depth of the critical layer is dependent upon vehicle weight and the characteristics of the soil's RCI profile. If the critical layer and the 6-in. layer below the critical layer have the same RCI or show an increase in RCI with depth, the strength profile is considered normal. If the 6-in. layer below the critical layer has an RCI less than

that of the normal critical layer, the RCI is considered abnormal and the 6-in. layer below the normal critical layer is used as the critical layer. The normal 50-pass critical layer for the vehicles considered in this study was the 6- to 12-in. layer.

28. The RCI of the critical layer is plotted versus the number of passes completed by each vehicle in plate 1. In these plots a clear-cut separation of immobilization and nonimmobilization was not always present. Therefore, the final selection usually produced a measured (experimental) VCI_{50} that was slightly conservative.

29. XM410E1. Test data are plotted in plate 1, fig. a, for this vehicle. Seven tests resulted in immobilizations and five tests resulted in the completion of 50 passes. Fig. 19 shows test 36 (item 4*) at Chotard Lake in progress. The XM410E1 completed 50 passes with ease in item 12 on an RCI of 32. In item 9 on an RCI of 26 the vehicle had considerable difficulty during the 50th to 54th passes. In item 10 on an RCI of 24 (just 2 RCI less than item 9), the vehicle became immobilized on the 17th pass. From these tests the experimental VCI_{50} was determined to be a conservative value of 32.

30. It should be noted that in items 1-5 (the preliminary tests described in paragraph 8) the vehicle test weight was 18,504 lb (12.1 percent greater than for the other tests). Because of the weight differential the test results of items 1-5 were not given as much consideration as the results of the other tests to determine VCI_{50} (and one-pass VCI's, discussed subsequently).

31. M35A2 (mod). Fourteen tests were conducted with this vehicle. These data are plotted in plate 1, fig. b. In item 13 on an RCI of 46 and in item 15 on an RCI of 44 the M35A2 became immobilized on the 41st and 47th passes, respectively. In item 14 on an RCI of 55 the vehicle completed 50 passes with some difficulty. Then in item 26 the M35A2 completed

* To facilitate the analysis of data and the presentation of data in tables, plates, etc., the tests were grouped according to type of test, vehicle, and test weight. Sequential "item" numbers were then assigned to the tests. In the remainder of the report, a test is identified by its corresponding item number.

a. After 1 pass

b. After 35 passes

c. After 50 passes

Fig. 19. VCI test in progress at Chotard Lake, XM410E1 (item 4)

50 passes with ease on an RCI of 59. From these tests the experimental VCI_{50} was placed at 56.

32. M113. Data from 15 tests conducted with the M113 are plotted in plate 1, fig. c. In item 39 on an RCI of 30 and in item 33 on an RCI of 27, the M113 made 50 passes with little difficulty. In item 37 on an RCI of 22 the M113 became immobilized on the 51st pass. Then, considering also the results of items 28 and 38, the experimental VCI_{50} for the M113 was conservatively placed at 29.

33. In items 27-32, the test weight of the M113 was 24,200 lb (7.1 percent greater than for the other tests). Because of the weight differential the test results of items 27-32 were not given as much consideration as the results of the other tests in determining experimental VCI_{50} (one-pass VCI is discussed subsequently).

34. MEXA 10x10. Eighteen VCI determination tests were conducted with the MEXA 10x10. Test results are plotted in plate 1, fig. d. In item 48 on an RCI of 15 the vehicle was considered to be immobilized on the 47th pass. In item 54 on an RCI of 19, although immobilization appeared to be imminent on the 50th pass, the test was continued through 54 passes without immobilization. Fig. 20 shows this test in progress at Carson Sink site 3. In items 50 and 53, on 22 RCI, 50 passes were completed without difficulty. From the results of these tests the experimental VCI_{50} was placed at 18.

35. In the preliminary tests conducted at Vicksburg, the tire inflation pressure of the MEXA 10x10 was 3.0 psi (average overall deflection of 31.6 percent) while in the comprehensive tests in Nevada tire deflection was set at 20 percent, yielding an average inflation of 7.3 psi. Plate 1, fig. d, indicates that this inflation pressure and deflection differential had little effect on the test results.

36. MEXA 8x8. Fourteen VCI determination tests were conducted with the MEXA 8x8. Test results are shown in plate 1, fig. e. Examination of the data shows that the MEXA 8x8 became immobilized in item 61 on an RCI of 20 on the 36th pass. Fig. 21 shows this test at WES in progress. Notes for item 6[illegible] show that the vehicle had no difficulty completing 50 passes on an RCI of 21, whereas in item 60 it had extreme difficulty completing

a. After 1 pass

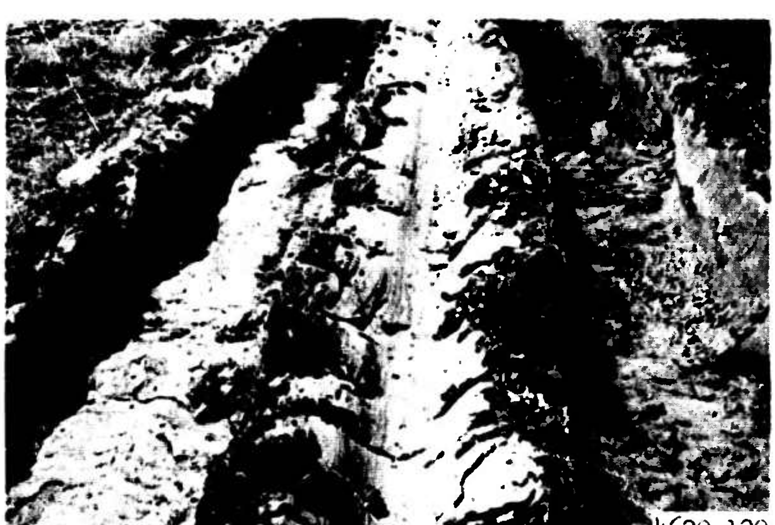
b. After 44th pass

c. After 54th pass

Fig. 20. VCI test in progress at Carson Sink site 3, MEXA 10x10 (item 54)

a. After 1 pass

b. On 26th pass



c. After 36 passes

Fig. 21. VCI test in progress at WES, MEXA 8x8 (item 61)

50 passes on an RCI of 22. Therefore, the separation point between go and no go for 50 passes was placed at an RCI of 23.

37. In tests conducted at Vicksburg, the average tire inflation pressure of the MEXA 8x8 was 5.2 psi (average overall deflection of 27.9 percent) while in the Nevada tests, tire deflection was set at 20 percent, yielding an average inflation pressure of 9.0 psi. Plate 1, fig. e, indicates that this inflation pressure and deflection differential had little effect on results of these tests.

38. MEXA track. Data for the 13 tests conducted with this vehicle are plotted in plate 1, fig. f. Ten tests resulted in immobilizations and three resulted in completion of 50 passes. In item 81 on an RCI of 20, the MEXA track was immobilized on the 44th pass. In item 83 on an RCI of 19 and in item 86 on an RCI of 20, the vehicle had considerable difficulty completing 50 passes. However, in item 82 on an RCI of 19, 50 passes were completed without difficulty. In item 83 the vehicle was allowed to continue through 54 passes without becoming immobilized. Based on these tests the experimental VCI_{50} was conservatively placed at 21.

39. Summary of VCI_{50} results. The following tabulation summarizes the results of experimental VCI_{50} determination:

Vehicle	Experimental VCI_{50}	Vehicle	Experimental VCI_{50}
XM410E1	32	MEXA 10x10	18
M35A2 (mod)	56	MEXA 8x8	23
M113	29	MEXA track	21

Determination of VCI for one pass

40. Most of the field test evidence collected to date in fine-grained soils indicates that one-pass go vehicle performance separates well from one-pass no-go vehicle performance on the basis of RCI. However, critical-layer criteria based on tests of a range of vehicles and varying RCI conditions have yet to be firmly established. There has been limited evidence indicating that the critical-layer criteria for 50 passes can be used in determining one-pass VCI for some vehicles with generally fair success; a determination of one-pass VCI based on the 50-pass critical-layer

criteria (hereafter referred to as $VCI_1(50)$) is discussed in the following paragraph.

41. Measured (experimental) $VCI_1(50)$ is shown in plate 1 in the plot for each vehicle. The plots reveal that for the majority of the tests there was generally satisfactory separation of go tests from one-pass no-go tests at the designated experimental $VCI_1(50)$ for the XM410E1, M35A2 (mod), M113, and MEXA track. However, it is apparent from examination of plate 1, figs. d and e, that experimental $VCI_1(50)$ is a poor indicator of one-pass performance for the MEXA 10x10 and MEXA 8x8. The test data for the MEXA 10x10 show that in five tests the vehicle completed between 1 pass and 39 passes on soils of strengths less than experimental $VCI_1(50)$. The MEXA 8x8 test data show that on six tests the vehicle completed between 2 and 27 passes on soils of strengths less than experimental $VCI_1(50)$. This suggests that the use of the present 50-pass critical-layer criteria in determining one-pass performance is not satisfactory for all vehicles. These results thus led to the data analysis presented in the following paragraphs.

42. Possible one-pass critical-layer criteria for the vehicles in the program were studied in plots (not included herein) of CI and RCI of the 0- to 6-in., 3- to 9-in., 6- to 12-in., 9- to 15-in., 12- to 18-in., and 0- to 12-in. layers, and of combinations of layers versus number of passes completed. The data in these plots were analyzed to find the layer that showed the best separation on the basis of go and no-go performance. The best overall one-pass critical-layer criteria for the six test vehicles were as follows: the 0- to 6-in. layer was considered to be the normal critical layer unless the RCI of the 6- to 12-in. layer was less than that of the 0- to 6-in. RCI, in which case the 6- to 12-in. layer was considered to be the critical layer.

43. For each test, the number of passes completed versus the RCI based on this tentative critical-layer criteria was plotted by vehicle in plate 2. (Hereafter the one-pass VCI based on the tentative critical-layer criteria is designated as VCI_{1t}.) The results are discussed in the following paragraphs. Figs. 22 and 23 show typical VCI test immobilizations.

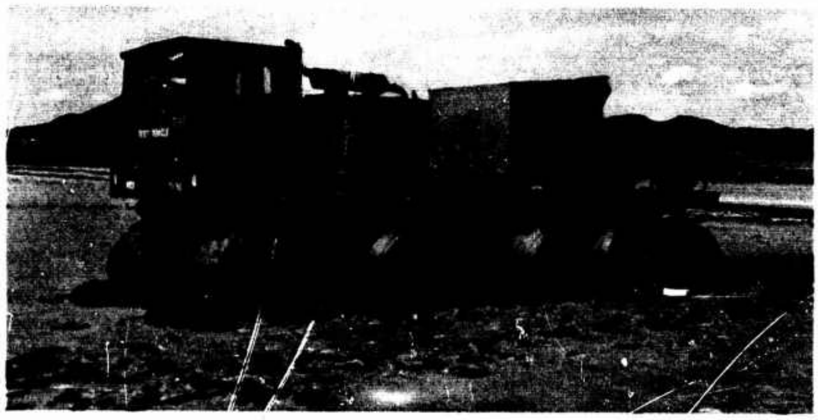
44. <u>XM410E1.</u> Test data for the XM410E1 are plotted in plate 2, fig. a. In determining measured (experimental) VCI_{1t} for the vehicle, more

a. XM410E1 was immobilized on 7th pass at Chotard Lake (item 5)

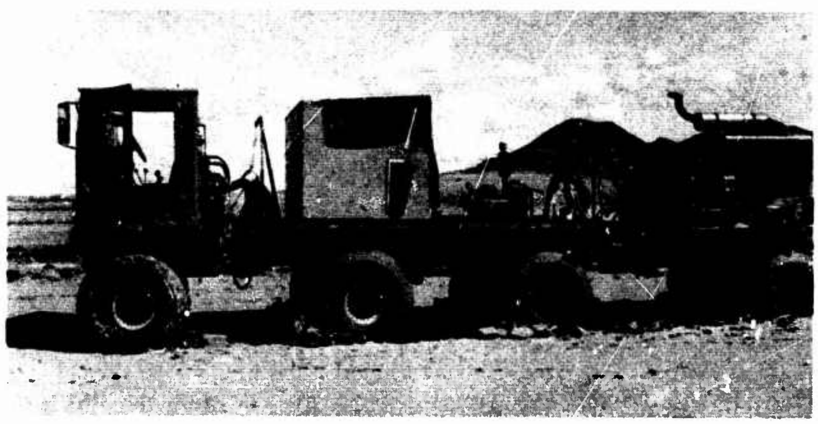
b. M35A2 (mod) was immobilized on 2d pass at Carson Sink site 2 (item 19)

c. M113 was immobilized on 1st pass at Four Mile Flat site 6 (item 41)

Fig. 22. Typical VCI test immobilizations, military vehicles



a. MEXA 10x10 was immobilized on 1st pass at Four Mile Flat site 7 (item 55)



b. MEXA 8x8 was immobilized on 1st pass at Four Mile Flat site 6 (item 72)

c. MEXA track was immobilized on 2d pass at Four Mile Flat site 8 (item 85)

Fig. 23. Typical VCI test immobilizations, MEXA vehicles

consideration was given to items 8, 7, 11, and 10 than to the other items. The XM410E1 was immobilized during item 8 on an RCI of 10 on the first pass and was immobilized in item 7 on an RCI of 17 on the 14th pass. However, because of the low immobilization pass number (fourth pass) in item 11 on an RCI of 21, the experimental VCI_{1t} was placed at 18.

45. M35A2 (mod). Plate 2, fig. b, shows a plot of test data for the M35A2 (mod). In item 22 the vehicle was immobilized on the first pass on an RCI of 22. In item 16 it was immobilized on an RCI of 24 on the fifth pass, whereas in item 19 it was immobilized on an RCI of 26 on the second pass. Then in item 18 on an RCI of 29 and in item 21 on an RCI of 30 the M35A2 (mod) was immobilized on the ninth and fourth passes, respectively. Based on these test results, the experimental VCI_{1t} was placed at 27.

46. M113. The RCI-number of passes completed relation for the M113 is shown in plate 2, fig. c. In item 40 on an RCI of 11, immobilization occurred on the first pass. Notes for this item indicate that had the soil strength been slightly higher, the M113 probably would have been able to complete one pass. Considering test results in items 30, 31, 32, 34, and 36, the experimental VCI_{1t} was placed at 15.

47. MEXA 10x10. Test results for the MEXA 10x10 are shown in plate 2, fig. d. In items 55 and 58 on an RCI of 6 the MEXA 10x10 was immobilized on the first pass. Then in items 59 and 47 on an RCI of 8 the vehicle was immobilized on the third and sixteenth passes, respectively. Based on these test results, the experimental VCI_{1t} was placed at 7.

48. MEXA 8x8. Test results for this vehicle are shown in plate 2, fig. e. In item 71 on an RCI of 10 the MEXA 8x8 was immobilized on the fifth pass; however, on this same RCI the test vehicle immobilized on the first pass in item 70. In items 63 and 73 on an RCI of 12 the MEXA 8x8 was immobilized on the third and fourth passes, respectively. Consideration was also given to item 62 in which the vehicle was immobilized on the eleventh pass on an RCI of 13. Based on these test results, the experimental VCI_{1t} for the MEXA 8x8 was placed at 11.

49. MEXA track. The RCI-number of passes completed relation for the MEXA track is shown in plate 2, fig. f. In item 74 the vehicle was immobilized on the first pass on an RCI of 5. In item 77 and item 84 the MEXA

track was immobilized on the second and sixth passes, respectively, on an RCI of 6. Based on these results and considering the results of items 78, 75, and 76, the experimental VCI_{1t} for the MEXA track was placed at 7.

50. Summary of VCI_{1t} results. The following tabulation summarizes the results of experimental VCI_{1t} determinations:

Vehicle	Experimental VCI_{1t}	Vehicle	Experimental VCI_{1t}
XM410E1	18	MEXA 10x10	7
M35A2 (mod)	27	MEXA 8x8	11
M113	15	MEXA track	7

51. In review, the experimental VCI_{1t}'s shown above were determined on the basis of the critical-layer criteria described in paragraph 42. These criteria were best for determination of the minimum soil strength that would permit the vehicle to make one pass. For the remaining vehicle performance parameters (drawbar pull, motion resistance, etc.), where soil strengths were, for the most part, greater than experimental VCI_{1t}, the 0- to 6-in. RCI correlated best with performance. Therefore, the following analyses are on the basis of 0- to 6-in. RCI.

Drawbar Pull Tests

52. Sixty-three drawbar pull tests were conducted, 6 on asphalt pavement and 57 on a range of soil strengths at test sites in Nevada. Fig. 24 shows vehicles in position for drawbar pull tests. Soil strength and related data for each test are summarized in table 3. Drawbar pull, torque, speed, and slip data for each test are summarized in table 4. In the following paragraphs, the relations of drawbar pull to speed, slip, and RCI of the 0- to 6-in. layer are discussed.

Drawbar pull-speed relations

53. For each drawbar pull-speed test, drawbar pull in terms of drawbar pull coefficient (drawbar pull, D, in pounds divided by vehicle weight, W, in pounds) was plotted versus speed, and curves of best visual fit were drawn through the data points. The curves are shown in plates 3 and 4.

a. Carson Sink site 3, MEXA track (item 137)

b. Four Mile Flat site 6, MEXA 10x10 (item 119)

Fig. 24. MEXA track and 10x10 in position prior to start of drawbar pull tests

(Because of the large amount of data, the measured points are shown in the M35A2 (mod) plot only.) The relations shown represent the maximum drawbar pull available for a given vehicle speed and a particular soil strength in terms of 0- to 6-in. RCI. The inflections in the curves indicate optimum speed for gear changes.

54. These curves show that, in general, as soil strength decreases

maximum drawbar pull at a given speed decreases. At speeds between 3 and 6 mph on soil strengths of 52 RCI and above, the MEXA 10x10 was able to develop drawbar pull values slightly higher than those developed on pavement (see plate 4, fig. a, items 110 and 114). Higher drawbar pull tests were not attempted with the MEXA 10x10 and MEXA 8x8 on pavement because mechanical failures of the MEXA 8x8 (see paragraph 63) had occurred at high drawbar pulls in tests on soils (items 123 and 128). At speeds less than about 8 mph the MEXA track developed higher drawbar pull values on soil than those developed on pavement (see plate 4, fig. c, items 133 and 139).

Drawbar pull and work
output index versus slip

55. Drawbar pull in terms of drawbar pull coefficient D/W versus wheel or track slip for each test was plotted and curves of best visual fit were drawn through the data points. An example of these plots is shown in fig. 25; D/W is represented by the solid line.

56. Since D/W varies with slip, the maximum D/W is a performance

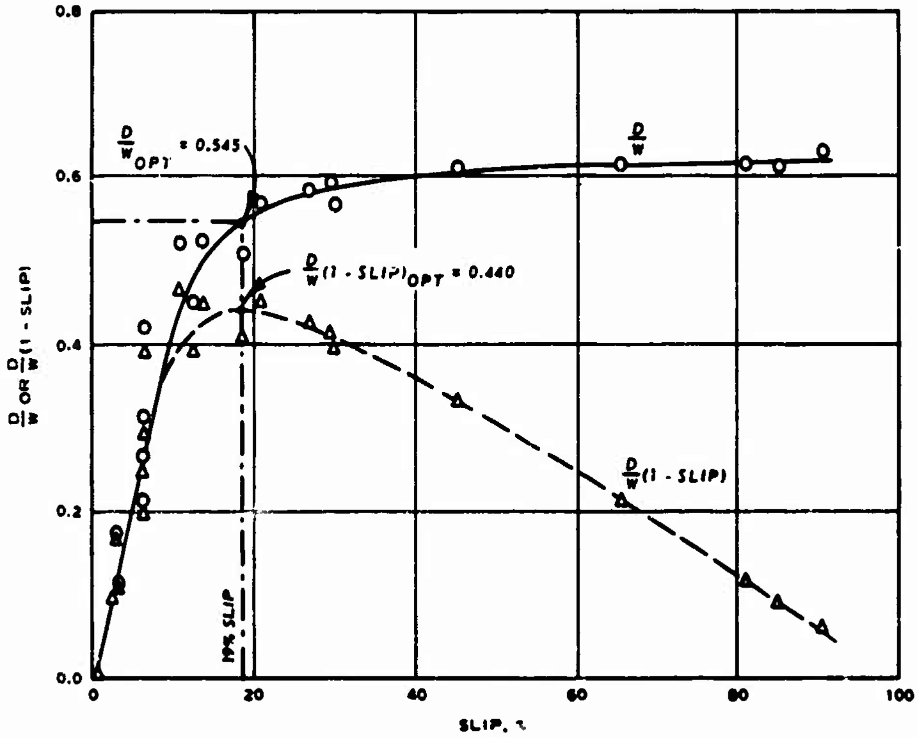


Fig. 25. Drawbar pull versus slip, MEXA 8x8 (item 126)

parameter often used in evaluating the traction capabilities of vehicles. However, in clay soils, the maximum drawbar pull usually occurs at or near 100 percent slip. At 100 percent slip, maximum D/W is not a meaningful parameter because no useful work can be done when a vehicle is not moving forward. A more meaningful performance parameter is the optimum D/W value, the value of D/W when the vehicle's work output index is at maximum. Work output index is a dimensionless number that indicates the vehicle's towing efficiency and is defined as follows:

$$\text{Work output index} = \frac{D}{W} \times \frac{\text{distance vehicle traveled}}{\text{distance tracks or wheels traveled}} = \frac{D}{W}(1 - \text{slip})$$

Optimum D/W values were determined from plots of D/W and work output index versus slip. An example is shown in fig. 25. Wheel or track slip at which the maximum work output index occurs is termed optimum slip.

57. RCI of the 0- to 6-in. layer, optimum drawbar pull $(D/W)_{opt}$, and optimum slip for each test used in the analysis are as follows:

Item No.	0- to 6-in. RCI	Optimum Drawbar Pull, lb	Optimum Drawbar Pull, Coef $(D/W)_{opt}$	Optimum Slip %
		XM410E1		
87	50	8,750	0.53	18
88	50	6,590	0.52	16
89	37	7,425	0.45	19
90	37	6,270	0.38	20
91	24	3,300	0.20	25
92	24	3,300	0.20	19
93	*	9,054	0.55**	5**
		M35A2 (mod)		
94	50	9,475**	0.52**	24**
95	50	9,475**	0.52**	20**
96	37	5,285	0.29	24
97	37	4,555	0.25	22
98	172	10,570	0.58	22
145	*	11,300**	0.62**	15**
		M11[illegible]		
99	5[illegible]	14,400	0.[illegible]4**	1[illegible]**
100	5[illegible]	12,150	0.54**	1[illegible]**
101	47	12,150	0.54	1[illegible]
102	37	11,[illegible]	0.50	15
103	24	[illegible]	0.40	1[illegible]
104	24	10,575	0.4[illegible]	17
105	15	4,150	0.14	17
106	15	4,500	0.30	20
146	*	14,[illegible]00**	0.[illegible]4**	2**
		MEXA 10x10		
107	52	12,260	0.68	20
108	35	11,720	0.65	20
109	35	12,620	0.70	21
110	52	12,620	0.70	19
111	23	8,655	0.48	20
112	23	9,735	0.54	20
113	162	12,050	0.67	19
114	162	12,620	0.70	17
115	13	2,345	0.13	27
116	15	2,345	0.13	23
117	23	11,900	0.[illegible]	1[illegible]
118	17	7,350	0.41	21
119	16	5,[illegible]	0.32	17
120	10	2,[illegible]	0.1[illegible]	20
121	11	2,525	0.14	1[illegible]
122	12	2,525	0.14	24
		MEXA 8x8		
123	5[illegible]	12,3[illegible]0	0.65	1[illegible]
124	25	7,225	0.35	15
125	25	[illegible],225	0.[illegible]	14
126	25	10,[illegible]	0.54	1[illegible]
127	2[illegible]	11,[illegible]	[illegible]	[illegible]
		MEXA 8x8 (Continued)		
128	49	13,[illegible]	0.7[illegible]	24
129	13	3,040	0.1[illegible]	[illegible]
130	13	2,750	0.15	20
131	14	1,710	0.0[illegible]	[illegible]
		MEXA Track		
132	52	15,155	0.[illegible]	15
133	52	15,350	0.[illegible]	15
134	32	12,[illegible]	0.[illegible]	15
135	32	13,[illegible]	0.[illegible]	1[illegible]
136	23	12,5[illegible]	0.[illegible]4	15
137	23	12,[illegible]	0.[illegible]	1[illegible]
138	154	12,[illegible]	0.[illegible]	1[illegible]
139	154	14,170	0.[illegible]2	1[illegible]
140	4[illegible]	14,170	0.[illegible]2	1[illegible]
141	4[illegible]	12,[illegible]	0.[illegible]	11
142	1[illegible]	[illegible]	[illegible]	1[illegible]
143	*	[illegible],150	[illegible]	[illegible]
144	*	[illegible]	[illegible]	[illegible]
147	*	1[illegible]	[illegible]	[illegible]

* Pavement.

** Vehicle reached its "power limit" before $(D/W)_{opt}$ was achieved. When the power train of a vehicle cannot deliver enough force to produce 100% slip between its traction elements and a particular ground condition, it is said to have reached its power limit.

$(D/W)_{opt}$ versus 0- to 6-in. RCI

58. $(D/W)_{opt}$ is plotted versus 0- to 6-in. RCI in plate 5. The experimental VCI_{1t} for each vehicle is also shown plotted as an x at zero $(D/W)_{opt}$. With the experimental VCI_{1t} values as guides, curves of best visual fit were drawn through the data points. Test results are discussed in the following paragraphs.

59. XM410E1. Item 93 was conducted on pavement with tires of the XM410E1 inflated to an average pressure of 35 psi. In this test the XM410E1 reached its power limit (the vehicle's engine stalled) developing a maximum D/W of 0.55 at 5 percent slip. Six drawbar pull tests were conducted on soil with the tires inflated to 12.2 psi. In items 87 and 88, the XM410E1 reached its power limit between 15 and 20 percent slip. The D/W and work output versus slip curves for these tests indicated that $(D/W)_{opt}$ values developed near the vehicle's power limit. The 0- to 6-in. RCI versus $(D/W)_{opt}$ for each test is plotted in plate 5, fig. a. The curve on this plot shows a sharp increase from zero to 0.47 $(D/W)_{opt}$ between an RCI of 17 and 50. Beyond an RCI of about 50 there was little increase in $(D/W)_{opt}$ with increase in soil strength.

60. M35A2 (mod). Six drawbar pull tests were conducted with the M35A2 (mod). The M35A2 (mod) reached its power limit (the vehicle's engine and wheels stalled) in the pavement test (item 145) and in soil test items 94 and 95. In the pavement test, the M35A2 (mod) developed a maximum D/W of 0.62 at 13 percent slip. In items 94 and 95, the M35A2 (mod) reached its power limit between 20 and 30 percent slip. The D/W and work output versus slip curves for these tests indicated that the $(D/W)_{opt}$ values were achieved near the vehicle's power limit. The RCI versus $(D/W)_{opt}$ curve in plate 5, fig. b, shows that between 27 and 50 RCI $(D/W)_{opt}$ increased sharply from zero to 0.52. Beyond about 50 RCI, $(D/W)_{opt}$ increased gradually with increase in soil strength.

61. M113. Nine drawbar pull tests were conducted with the M113. The vehicle reached its power limit (the vehicle's tracks stalled but the engine did not) in the pavement test (item 146) and in two soil tests (items 99 and 100). In the pavement test, the M113 reached its power limit developing a maximum D/W of 0.64 at about 2 percent slip. In items 99

and 100, the M113 reached its power limit at 28.0 and 23.8 percent slip, respectively. In plate 5, fig. c, the RCI-$(D/W)_{opt}$ curve is steep between a $(D/W)_{opt}$ of zero and 0.50, indicating a great increase in pull between 15 and 50 RCI. Beyond 50 RCI there is only a gradual increase in $(D/W)_{opt}$ with increase in soil strength.

62. MEXA 10x10. Sixteen drawbar pull tests were conducted with the MEXA 10x10. Plate 5, fig. d, is a plot of $(D/W)_{opt}$ versus RCI for the MEXA 10x10. The plot shows that as RCI increased from 7 to 35, $(D/W)_{opt}$ increased from 0 to 0.65. Values of $(D/W)_{opt}$ increased only slightly between 65 and 162 RCI. The MEXA 10x10 had sufficient power to produce 100 percent slip in all tests. In item 110, the MEXA 10x10 developed a maximum pull of 18,328 lb (1.02 D/W) at 100 percent slip (see table 4).

63. MEXA 8x8. RCI versus $(D/W)_{opt}$ data for nine drawbar pull tests conducted with the MEXA 8x8 are shown in plate 5, fig. e. The curve shows an increase in $(D/W)_{opt}$ from zero to 0.62 between 11 and 45 RCI. In item 123 the MEXA 8x8 developed a maximum pull of 18,316 lb (0.96 D/W). At this pull, Nos. 3 and 4 differentials failed and had to be replaced. Furthermore, in item 128 the Nos. 3 and 4 differentials failed at 0.71 D/W. Because of these costly mechanical failures, high drawbar pulls on firmer soils and on pavement were not attempted.

64. MEXA track. RCI versus $(D/W)_{opt}$ data for the 14 tests conducted with the MEXA track are shown in plate 5, fig. f. The plot shows an increase in $(D/W)_{opt}$ from zero to 0.65 between 7 and 35 RCI. Beyond 35 RCI, $(D/W)_{opt}$ increased gradually with increase in soil strength. The MEXA track had ample power to generate 100 percent slip at the tracks in all tests. In item 133, the MEXA track had a maximum of 1.02 D/W at 100 percent slip. In the pavement test (item 149) the MEXA track was able to pull 0.87 D/W at 21.1 percent slip; had the cable between the load vehicle and test vehicle not failed in this test, higher pull and slip values probably would have been developed.

Towed Motion Resistance

65. The towed motion resistance for each vehicle was measured following most drawbar pull tests. A summary of the soil data for each test

is presented in table 3. One-pass towed motion resistance (in pounds and as a coefficient R/W where R equals motion resistance in pounds and W equals vehicle weight in pounds) and 0- to 6-in. RCI for each test are tabulated below. The coefficient R/W and the RCI for each test are plotted in plate 6. A curve of best visual fit was drawn through the data points.

Item No.	0- to 6-in. RCI	Motion Resistance lb	Motion Resistance Coefficient R/W
	XM410E1		
87	50	1565	0.09
89	37	2150	0.13
91	24	3225	0.20
153	189	992	0.06
93	Pavement	592	0.04
	M35A2 (mod)		
94	50	2062	0.11
96	37	3500	0.19
98	172	1373	0.08
145	Pavement	726	0.04
	M113		
99	53	1821	0.08
101	37	2780	0.12
103	24	3560	0.16
161	189	1469	0.06
146	Pavement	1024	0.04
	MEXA 10x10		
108	35	1260	0.07
110	52	750	0.04
	MEXA 10x10 (Continued)		
111	23	1490	0.08
113	162	770	0.04
115	13	1545	0.09
122	12	1750	0.10
147	Pavement	561	0.03
	MEXA 8x8		
124	25	1680	0.09
126	29	1575	0.08
128	49	1325	0.07
148	Pavement	641	0.03
130	13	3323	0.17
131	14	4172	0.22
	MEXA Track		
132	52	1800	0.09
134	32	2020	0.10
136	23	2360	0.12
138	159	1500	0.08
149	Pavement	1136	0.06
142	16	6520	0.33
144	6	9070	0.46

XM410E1, M35A2 (mod), and M113

66. In plate 6, figs. a, b, and c, the test data for the XM410E1, the M35A2 (mod), and the M113 show that an R/W of 0.04 was measured on pavement. Then the curves show a gradual increase in R/W from pavement to an RCI of about 50. Below about 50 RCI, R/W increased rapidly with little decrease in RCI. The lowest strengths tested show an R/W of 0.20 on 24 RCI for the XM410E1, an R/W of 0.19 on 37 RCI for the M35A2 (mod),

and an R/W of 0.16 on 24 RCI for the M113.

MEXA 10x10

67. In plate 6, fig. d, the MEXA 10x10 curve shows an R/W of 0.03 on pavement. Below pavement strength, R/W increased little as RCI decreased to about 30. From an RCI of 30 to an RCI of 12, R/W increased gradually from 0.06 to 0.10.

MEXA 8x8

68. The MEXA 8x8 curve, plate 6, fig. e, indicates a gradual increase from pavement R/W (0.03) to an RCI of about 30. Below about 30 RCI, the curve shows that R/W increased rapidly to 0.22 at 12 RCI.

MEXA track

69. In plate 6, fig. f, the MEXA track data show an R/W of 0.06 on pavement. This, the highest R/W measured on pavement for the vehicles tested, reflects the mass of the MEXA track's track system. R/W increased gradually as strength decreased from pavement to an RCI of 30. Below about 30 RCI, the curve shows that R/W increased rapidly to 0.46 at an RCI of 6.

Speed Tests

70. Forty-four speed tests were conducted, nine on pavement and 35 on a range of soil strengths, at Vicksburg and Fallon. Soil strength and related data for each test are summarized in table 5. Each test was conducted as described in paragraph 21. The relations developed for each vehicle are shown in plates 7 and 8 as speed versus time. Only curves are shown since the individual data are numerous; however, the data are on file at WES. These curves were used principally to obtain maximum speed-soil strength relations; however, measures of acceleration and deceleration can be obtained. A detailed analysis of acceleration and deceleration is not within the scope of this report; therefore, these performance parameters are discussed in general terms and no attempt is made to relate them to soil strength in this analysis.

71. Once maximum speed was believed attained, the driver disengaged the power train and allowed the vehicle to roll to a stop. Deceleration portions of the speed-time curves in plates 7 and 8 are more clearly

defined than are the acceleration and time required to reach maximum speeds. There should be a relation between slopes of deceleration curves and soil strength, and also the deceleration curves should be straight lines if the only factor affecting deceleration were soil strength. However, in some cases, pavement tests in particular, the deceleration curves are convex in shape. One of the additional factors that probably affected deceleration is wind resistance; however, further study will be required before definite relations can be developed.

Maximum speed versus soil strength

72. The maximum vehicle speeds and soil strengths in terms of the 0- to 6-in. RCI used in the analysis are as follows:

Item No.	0- to 6-in. RCI	Vehicle: Maximum Speed mph	Vehicle: Range and Transmission*
		XM410E1	
152	24	12.1	L-1, L-2, L-3
151	35	20.0	L-1, L-2, L-3
150	49	[illegible]	L-1, L-2, L-3
153	189	28.5	H-1, H-2
[illegible]	Pavement	33.0**	H-1, H-2, H-3
		M35A2 (mod)	
[illegible]	35	[illegible]	L-1, L-2
154	[illegible]	9.1	L-1, L-2
155	49	14.4	L-1, L-2, L-3
157	189	25.9	L-1, L-2, L-3, L-4, L-5
187	Pavement	39.5	H-1, H-2, H-3, H-4, H-5
[illegible]	Pavement	32.3**	H-1, H-2, H-3, H-4, H-5
		M113	
[illegible]	[illegible]	7.8	1-2
[illegible]	24	10.8	1-2
[illegible]	35	[illegible]	1-2, 3-5
[illegible]	50	17.3	1-2, 3-5
[illegible]	[illegible]	[illegible]	1-2, [illegible]
[illegible]	Pavement	[illegible]	[illegible]
		MEXA 10x10	
[illegible]	11	[illegible]	L-1, L-2
[illegible]	[illegible]	[illegible]	H-1, H-2
[illegible]	[illegible]	[illegible]	H-1, H-2
[illegible]	[illegible]	[illegible]	H-1, H-2
		MEXA 10x10 (Continued)	
168	69	17.3	H-1, H-2
166	174	21.3	H-1, H-2
190	Pavement	20.9	H-1, H-2
191	Pavement	22.5**	H-1, H-2
		MEXA 8x8	
177	12	4.9	H-1, H-2
176	12	7.2	L-1, L-2
178	13	9.7	H-1, H-2
175	15	7.2	L-1, L-2
174	16	8.4	L-1, L-2
170	19	12.0	H-1, H-2
173	21	12.9	H-1, H-2
172	29	16.2	H-1, H-2
169	33	14.7	H-1, H-2
171	49	16.3	H-1, H-2
192	Pavement	22.2	H-1, H-2
193	Pavement	22.9**	H-1, H-2
		MEXA Track	
184	6	2.2	L-1, L-2
183	10	3.5	L-1, L-2
181	24	10.6	H-1, H-2
180	[illegible]	11.0	H-1, H-2
179	49	12.2	H-1, H-2
182	193	15.[illegible]	H-1, H-2
185	Pavement	[illegible]	H-1, H-2

* L and H denote low and high, respectively.
** [illegible] with tires inflated to pressures recommended for use on hard-surface roads (i.e., XM410E1, [illegible] psi; M35A2 (mod), 70 psi; MEXA 10x10, 15 psi; and MEXA 8x8, 15 psi).

73. Maximum vehicle speed is plotted versus 0- to 6-in. RCI in plate 9; included in each plot is the maximum vehicle speed achieved on pavement. The maximum speed values were obtained from plates 7 and 8. A curve of best visual fit was drawn through the data points. The dashed portions of the curves were determined by extrapolating between the lowest RCI-maximum speed value and experimental VCI_{1t} - 1 plotted at zero speed for each vehicle. VCI_{1t} - 1 was assumed to be the soil strength that would cause immobilization. Extrapolation between VCI_{1t} - 1 and lowest RCI-maximum speed value was necessary in order to obtain an approximate speed value for VCI_{1t} because of difficulty in locating test sites having soil strengths equal to experimental VCI_{1t} for each vehicle. The the curves show that at VCI_{1t} speed for all six vehicles tested was approximately 2.5 mph.

Acceleration and deceleration

74. As can be seen in plates 7 and 8 for a given vehicle and soil strength, uniform acceleration did not develop, generally, because of shifting of gears. Gear shifting can be seen as inflections in the speed-time curves (plate 7, fig. a). In several tests toward the end of the acceleration period, erratic speed-time curves were developed (item 153, plate 7, fig. a); this was not fully explainable and needs further study.

75. The development of relations between acceleration and soil strength is not presented. One of the difficulties in relating acceleration to soil strength is that, of necessity, vehicle range and transmission were varied from test to test. For each test a range and transmission gear were selected to produce maximum vehicle speed, which in some cases did not necessarily provide the maximum acceleration that could be obtained. Furthermore, in some tests deceleration was not started at the proper time. For example, in item 150 (plate 7, fig. a) it appears that deceleration was started before maximum vehicle speed had been reached. Also, in item 152 it is shown that the vehicle reached maximum speed in about 15 sec; however, the driver continued, attempting to regain the maximum speed once speed was reduced. It is probable that the maximum speed was reached in L-2* gear combination and the vehicle shifted into L-3 and speed was

* L-2, etc., denotes low second, etc.

reduced. Had the vehicle continued in L-2, the speed might have been slightly higher.

76. XM410E1. Five speed tests were conducted with the XM410E1. In the maximum speed on pavement test (item 186), the XM410E1 tires were inflated to 35-psi pressure (recommended pressure for XM410E1 tires on pavement). In all other XM410E1 tests, the average tire inflation pressure was 12.2 psi. The curve in plate 9, fig. a, shows that as soil strength increased from an experimental VCI_{1t} of 18 to about 50 RCI, speed increased sharply from 2.5 to 22.5 mph. As soil strength increased beyond 50 RCI, speed increased gradually. A top speed of 53 mph was developed on pavement.

77. M35A2 (mod). RCI's versus maximum speeds for the M35A2 (mod) tests are shown in plate 9, fig. b. Four tests were conducted on soil and two tests on pavement. In one of the pavement tests (item 188), tire inflation pressure was 70 psi (recommended pavement pressure). In all other tests, average tire pressure was 20 psi. The higher tire inflation pressure increased the maximum speed on pavement of the M35A2 (mod) by 12.8 mph. The curve in plate 9, fig. b, shows an increase in speed from 2.5 to 52 mph between an experimental VCI_{1t} of 27 and pavement.

78. M113. Six speed tests were conducted with the M113. The curve in plate 9, fig. c, shows that as soil strength increased from an experimental VCI_{1t} of 15 to about 50 RCI, speed increased sharply from 2.5 to 17.3 mph. Beyond an RCI of 50, speed continued to increase gradually to about 30.2 mph on pavement.

79. MEXA 10x10. Eight speed tests were conducted with the MEXA 10x10. Results are plotted in plate 9, fig. d. In item 191 the MEXA tires were inflated to a pressure of 15 psi (recommended pavement pressure). In all other tests the inflation pressure was 7.3 psi. The increased tire inflation pressure increased the MEXA 10x10 maximum speed on pavement by 1.6 mph. The curve shows that as soil strength increased from an experimental VCI_{1t} of 7 to 35 RCI, speed increased from 2.5 to 17.0 mph. Beyond 35 RCI, speed increased gradually to a maximum of 22.5 mph on pavement.

80. MEXA 8x8. Speed test data for the 12 tests conducted with the MEXA 8x8 are shown in plate 9, fig. e. In item 193 the MEXA tire inflation pressure was 15 psi (recommended pavement pressure). At this pressure the

MEXA 8x8 reached a maximum speed of 22.9 mph, but in reaching this speed the vehicle's front unit experienced excess lateral movement which caused the driver concern for his safety. However, when inflation pressure was reduced to 9 psi the maximum speed on pavement was decreased by only 0.7 mph and lateral movement of the front unit was not excessive. The curve in plate 9, fig. e, shows an increase in speed from 2.5 to 17.5 mph from an experimental VCI_{1t} of 11 to an RCI of 45, indicating that the MEXA 8x8 is sensitive to small changes in soil strength. Beyond 45 RCI, this sensitivity decreases.

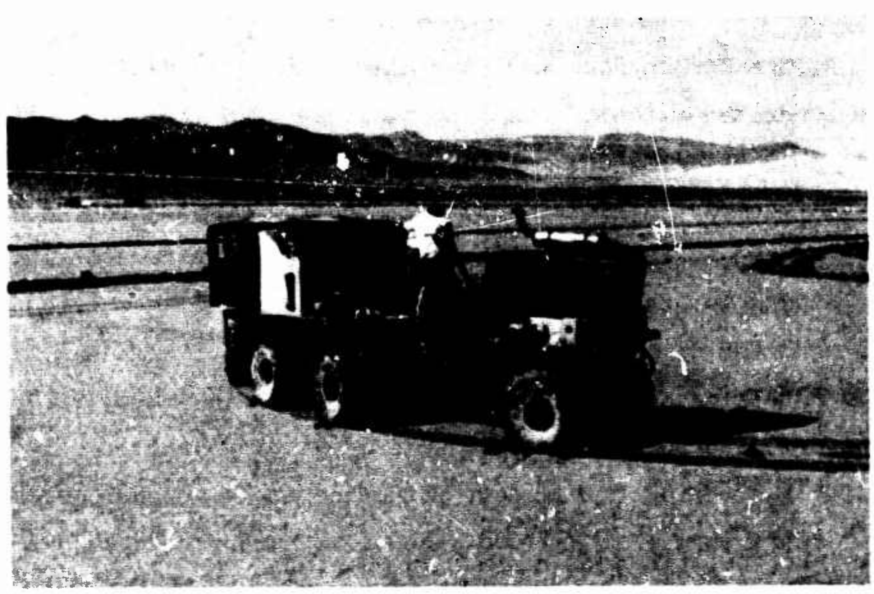
81. MEXA track. Seven tests were conducted with the MEXA track. A plot of the test data is shown in plate 9, fig. f. The curve for these data indicates that as soil strength increased from an experimental VCI_{1t} of 7 to 30 RCI, speed increased sharply from 2.5 to 10.5 mph. Between 30 RCI and pavement, speed increased gradually to a maximum of 16.2 mph.

Maneuver Tests

82. At the Carson Sink and Four Mile Flat tests sites 101 maneuver tests were conducted with the six test vehicles on a range of soil strengths. Soil strength and related data for each test are summarized in table 6. The one-pass average speed and measured turning radius for each test are presented in table 7. Also shown in table 7 are steering angle and corresponding torque data for tests with the Ackerman-steered XM410E1 and M35A2 (mod) and with the articulated steering of the MEXA 10x10 and MEXA track. Steering angle and torque data in turning tests with the M113 were not recorded because the M113 is a skid-steer vehicle and it is not equipped with a steering transducer. Steering angle and torque data were recorded in tests with the MEXA 8x8. However, because reduction of the torque record produced negative torque that could not be reconciled in some tests, the data were considered to be questionable and are not included in the analysis. The analysis of the maneuver test data consists of the development of turning radius-speed relations, force-steering angle relations, and force-RCI relations. These relations are presented and discussed in

the following paragraphs. Typical maneuver tests in progress are shown in fig. 26.

a. MEXA 10x10 after completing a left turn at Carson Sink site 4 (item 240)



b. MEXA 8x8 after completing a right turn at Four Mile Flat site 6 (item 271)

Fig. 26. Typical maneuver tests in progress

Turning radius-speed relations

83. Turning radius (in feet) and speed (in miles per hour) data were plotted for each of the test vehicles, and curves of best visual fit were drawn through the data points. These plots are presented in plate 10. The 0- to 6-in. RCI for each turn is also shown in the respective plot. The turning radii were obtained from planimetric maps that show the path taken by the outside edge of the outside wheel or track of the vehicles in each test. The average speed for most turn tests was calculated from measurements of time and distance. The time and distance required for the vehicle to roll to a stop after the vehicle power train was shifted into neutral (paragraph 21) were excluded from the average speed computation.

84. The relations developed in plate 10 show that, in general, for the range of speeds tested, as speed increased turning radius increased. Although there is no indication of a strong correlation between soil strength and turning radius for a given vehicle, it is probable that differences in soil strength may have contributed to the scatter of the data in plate 10. Also, test procedures created some difficulty in determining the turning radius in some of the tests, and this could account for part of the scatter.

Force-steering angle relations

85. For the XM410E1, M35A2 (mod), MEXA 10x10, and MEXA track, performance in terms of force (at the wheel- or track-ground interface) computed from drive-line torque divided by vehicle weight (F_T/W) was plotted versus steering angle in degrees for each turn test. F_T was computed without regard to efficiency losses between the torque sensor and wheel- or track-ground interface. A curve of best visual fit was drawn through data points for each turn test. The curves were grouped by vehicle according to tests conducted at approximately the same speed and are presented in plates 11 and 12. For each curve (represented by item numbers) the corresponding 0- to 6-in. RCI and the average speed are tabulated below the respective plot.

86. The curves show the relation of steering angle to F_T/W from the straight-line position (0 deg) through the steering action to the maximum steering angle (MSA). These relations indicate that, generally, during

the steering action F_T/W increased very gradually for the wheeled vehicles and gradually for the MEXA track between zero steering angle and about 5 deg less than maximum steering angle (MSA - 5 deg). At about MSA - 5 deg, F_T/W usually began to increase sharply, and in most cases F_T/W reached a maximum at the MSA. Tabulated below are the average MSA for each vehicle, the average increase in F_T/W from zero steering angle to MSA - 5 deg, and the average increase in F_T/W from zero steering angle to MSA. The MSA values shown are average values since the MSA for each vehicle deviated slightly from test to test. This deviation probably was caused by slack in each vehicle's steering system.

Vehicle	Avg MSA deg	Avg Increase in F_T/W from Zero Steering Angle to MSA - 5 deg	Avg Increase in F_T/W from Zero Steering Angle to MSA
XM410E1	29.0	0.02	0.06
M35A2 (mod)	24.5	0.03	0.07
MEXA 10x10	25.9	0.02	0.07
MEXA track	27.2	0.07	0.13

87. The tabulation above shows that the increase in F_T/W was about the same between zero steering angle and MSA - 5 deg for the three wheeled vehicles, but that for the MEXA track the increase was about double that of the wheeled vehicles. This was also true of the average increase in F_T/W from zero steering angle to MSA.

88. As shown in the plots, the curves for each vehicle exhibit the same general shape and tend to separate according to soil strength. The plots show that generally as soil strength decreases, F_T/W tends to increase. The plots also indicate that for the range of speeds tested with a particular vehicle, differences in speed had little effect on force-steering angle relations.

F_T/W versus 0- to 6-in. RCI

89. Report 3 of this series[6] states that steering angles above MSA - 5 deg are seldom needed for maneuvering even at obstacle spacings approaching the minimum required by the vehicles. Therefore, the MSA - 5 deg value is of interest since it appears to be a more practical value with

which to analyze vehicle force and its relation to soil strength.

90. The soil strength parameter that showed the best correlation with F_T/W was the 0- to 6-in. RCI. A plot of F_T/W at MSA - 5 deg for the lowest vehicle speed in each soil strength versus the 0- to 6-in. RCI is shown in plate 13. Curves of best visual fit were drawn through the data points for each vehicle. The F_T/W values were obtained from the curves developed in plates 11 and 12. Data used to prepare plate 13 are summarized below.

Item No.	0- to 6-in. RCI	F_T/W at MSA - 5 deg
	XM410E1	
194	44	0.12
198	29	0.12
202	24	0.17
206	194	0.07
	M35A2 (mod)	
210	46	0.14
214	34	0.20
218	198	0.07
	MEXA 10x10	
238	50	0.11
242	35	0.14
	MEXA 10x10 (Continued)	
246	24	0.14
250	210	0.06
254	19	0.06
256	14	0.08
	MEXA Track	
274	52	0.21
278	32	0.23
282	24	0.25
286	154	0.21
290	17	0.44
291	15	0.44
293	7	0.46

91. The curves in plate 13 show that for the XM410E1, M35A2 (mod), and MEXA 10x10 F_T/W increases only slightly between about 200 and 50 RCI. Below 50 RCI, F_T/W increases rapidly with little decrease in RCI. Two data points for the MEXA 10x10 (items 256 and 254) did not fit the general shape of the curves. No reason can be given for these apparent anomalies; however, erroneous torque data are suspected. The curve for the MEXA track indicates a slight increase in F_T/W between 160 and 30 RCI. Below 30 RCI, F_T/W increased rapidly with decrease in RCI. One noteworthy aspect of these plots is that the shape of the curves compares favorably with the curves developed in the towed motion resistance analysis.

92. Plots were also made, but are not included herein, of F_T/W at

MSA - 5 deg versus the 0- to 6-in. RCI at other vehicle test speeds. These plots revealed little change in the magnitude or shape of the curves presented in plate 13.

Minimum soil strength

93. In table 6, the 0- to 6-in. RCI's for items 272, 273, 293, and 294 show that the MEXA 8x8 and the MEXA track are capable of maneuvering on soil strengths equal to their respective experimental VCI_{1t}'s. For the other vehicles tested, the maneuver data are not sufficient to permit performance determinations based on soil strength alone. However, the results tabulated in paragraph 86 were considered once again, and the following statements can be made regarding these vehicles.

94. F_T/W is considered to be a relative measure of motion resistance. Keeping in mind that the VCI_{1t} of the MEXA track was established at 7, the data show that on RCI's of 7 and 6 the increased motion resistance from zero steering angle to maximum steering angle was not great enough to cause immobilization. Then since the XM410E1, M35A2 (mod), and MEXA 10x10 show a smaller increase in F_T/W with increasing steering angle than did the MEXA track, it follows that these vehicles also should be able to maneuver on soil strengths equal to their respective VCI_{1t}'s. As for the M113, additional test data are needed to determine the mir [illegible] strength required for maneuvering; however, since the M113 [illegible] skid-steer vehicle, it is felt that it might require a soil strength slightly higher than VCI_{1t} for maneuvering.

95. The preceding analysis indicates that five of the six vehicles tested should be able to maneuver in soil strengths as low as their respective VCI_{1t}'s. Nevertheless, since motion resistance was shown to increase during a turn and increase in motion resistance reduces the maximum speed a vehicle can attain, it follows that maximum speed in a turn will be less than the maximum straight-line speed on a given soil strength. The following tabulation presents the maximum turn speeds and their related soil strengths. For comparison purposes, the tabulation also shows maximum straight-line speed for each soil strength (acquired from the speed-soil strength curves in plate 9).

Vehicle	0- to 6-in. RCI	Max Speed, mph Turn	Straight Line
XM410E1	24	10.3	12.0
M35A2 (mod)	34	6.5	8.0
M113	25	5.1	12.0
MEXA 10x10	12	5.2	5.5
MEXA 8x8	11	2.7	2.5
MEXA track	7	2.8	2.5

The tabulation above shows that in four of the six tests, straight-line speed was greater than turn speed. The results of two tests are considered anomalies because turn speed is greater than straight-line speed. Such anomalies are especially likely to occur in this kind of a comparison when the RCI value is near or at VCI_{1t} because the value of VCI_{1t} is usually slightly conservative. (Note that VCI_{1t} is 11 for the MEXA 8x8 and 7 for the MEXA track; see paragraph 73.) However, despite these anomalies, the data, in general, tend to support the hypothesis that the motion resistance encountered in a turn causes a decrease in the maximum speed of vehicles.

Performance of MEXA Vehicles' Articulated Steering and Inching Systems in Soft Soils

96. The three MEXA vehicles were equipped with articulated and "inching" systems. The articulated joint between each vehicle unit is, in the free position, capable of roll, pitch, and yaw. The inching system between each unit has the ability to move one unit of the vehicle while the others remain stationary. The maximum extension distance of each inching unit is 2 ft. (In fig. 27b, the inching cylinder between the two units of the MEXA track vehicle is shown in extended position.)

97. In seventeen of the VCI tests, after the vehicle became immobilized, the operator attempted to extricate the vehicle by means of articulating and/or inching. Vehicle performance in each test is described in the remarks column in table 2. The tests in which one or both of the systems were used are indicated in the following tabulation and results are discussed in the following paragraphs.

Vehicle	Item No.	System Tested: Articulated	System Tested: Inching
MEXA 10x10	42	x	x
	43	x	x
	44	x	x
	45	x	x
	47	x	x
	48	x	
	49	x	x
	51	x	
	52	x	
MEXA 8x8	62		x
	65	x	x
MEXA track	77	x	x
	79	x	x
	80		x
	81		x
	84	x	x
	85	x	x
Total	17	14	14

Articulated steering

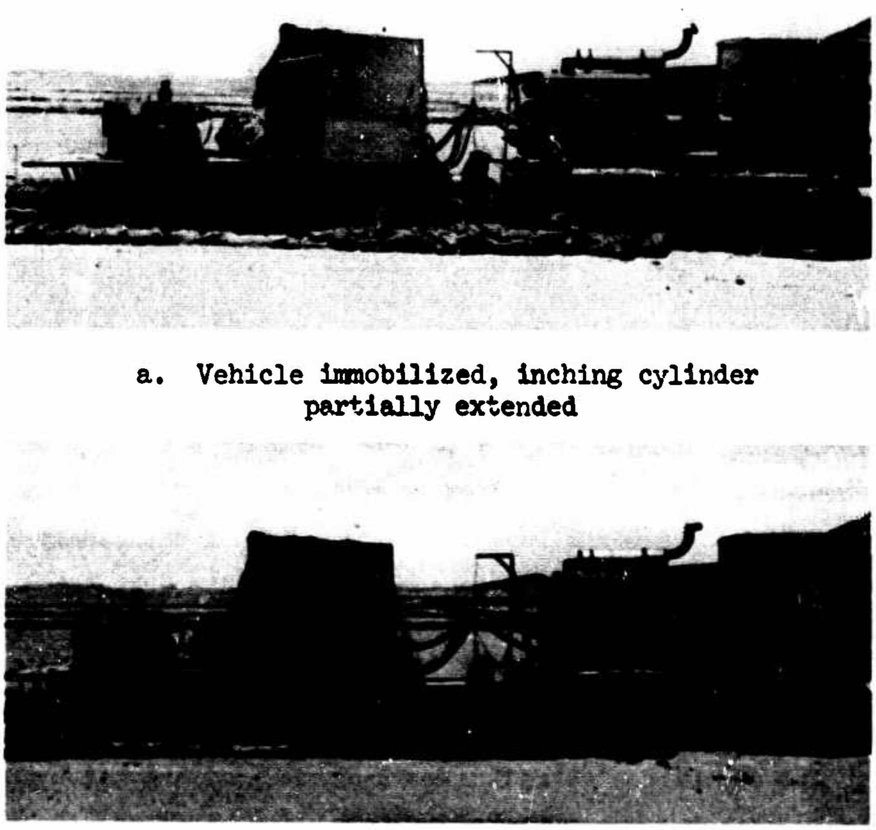
98. The roll, pitch, and yaw actions of the articulated joints of each MEXA vehicle were used in combination. Within limits, pitch and yaw actions can be controlled mechanically by the vehicle driver. With the articulated joint in free state, roll is induced by the terrain configuration over which the vehicle is traveling and cannot be controlled mechanically by the driver. Of the 14 attempts to extricate a vehicle by articulation, the MEXA 10x10 was the only vehicle that was able to extricate itself from an immobilization. The MEXA 10x10 attempted to become mobile through the use of the articulated steering in nine tests; attempts in four of the tests were successful. In item 48 the articulating action allowed the vehicle to extricate itself in a forward direction from the immobilization. In items 49, 51, and 52, test conditions were similar. In these three tests, the MEXA 10x10 was backed into the soft soil area until it became immobilized. The test vehicle first attempted to continue backing across the soft soil using articulation but was not able to do so. The

vehicle then attempted to pull forward without articulating and could not. Articulation was again used and the MEXA 10x10 was able to gain enough traction to pull itself out in forward onto the firm ground that lay immediately in front of the vehicle.

99. Results of these tests indicate that articulation is of limited value as a means of extricating the MEXA vehicles from an immobilization caused by soft soil.

Inching system

100. The inching system (fig. 27) was designed so that, in theory, a vehicle could utilize inching to extricate itself from an immobilization in the following manner. With a vehicle composed of units A and B at the minimum length position (contracted), the operator can brake unit B and apply power to unit A and at the same time activate the inching cylinder located



a. Vehicle immobilized, inching cylinder partially extended

b. Vehicle immobilized, inching cylinder fully extended

Fig. 27. MEXA track at Four Mile Flat site 8 (item 85)

between the two vehicle units. Thus, unit A can develop tractive effort and push against unit B with the inching cylinder. This would enable unit A to move to a new ground position. The functions of the two units are then reversed and unit B is drawn up to unit A. The vehicle could supposedly inch forward or backward to a position where the ground was firm enough to allow the vehicle to travel conventionally without inching.

101. The inching system was used on 14 immobilization tests. Fig. 27 shows the MEXA track during one test. The inching system was helpful in extricating the vehicle in only one test (item 62, with the MEXA 8x8). In 12 tests, either both units moved away from each other, although one unit's brakes were locked, or one unit remained stable whether it was supposed to or not, forcing the other unit to move to and from the first unit. The general observation made by test personnel was that once a MEXA vehicle became immobilized due to a soft soil condition, the more the inching system was used, the more deeply embedded the vehicle became.

102. These results indicate that for the MEXA vehicle, only in rare situations will the inching system contribute to a vehicle's efforts to extricate itself from an immobilization caused by soft soil.

Further Analyses

103. The analyses presented herein have been based on those aspects of the test data necessary to satisfy the purpose of the immediate program. The data collected during this program lend themselves to further analyses directed toward more detailed studies of acceleration, deceleration, and drive-line torque characteristics. This extension of data analyses would provide a basis on which to evaluate aspects of motion resistance, speed, and maneuver test procedures and vehicle response measurements and their ability to establish meaningful soil-vehicle relations. Additional analyses of these data are planned for the future.

104. The experience gained from the conduct of the tests and analyses of data in this program points up the need for updating and standardizing test procedures for conducting comprehensive soil-vehicle test programs.

Mechanical and Operational Problems of the MEXA Vehicles

Mechanical failures

105. During the course of the test program reported herein the following major mechanical failures occurred.

- a. The MEXA 8x8 had five differential failures during the test program. These failures occurred in tests where the torque demand was at or near maximum torque output.
- b. During a speed test on pavement the welds that held the MEXA 10x10 center drop box in place failed, allowing the center drive shaft to drop, causing extensive damage to both center drive shaft and drop box.
- c. Numerous fatigue cracks developed in the vehicle frame of the MEXA 10x10 and MEXA 8x8.
- d. On two occasions the main bearing of the power train at the back unit of the MEXA 10x10 failed.
- e. The passive air springs of the MEXA 8x8 had to be relocated to prevent the spring support brackets from excessive deflections.
- f. On two occasions high pressure hoses of the MEXA vehicles' hydraulic system ruptured.

Vehicle operation

106. The following deficiencies were noted during test operation of the MEXA vehicles.

- a. At times, especially at high speeds, the steering response of the MEXA vehicles was slow.
- b. Each time a MEXA vehicle was moved the vehicle's transmission and transfer case controls had to be adjusted to make gear shifting possible. The driver made this adjustment within 2 or 3 min by opening and closing a pressure release valve.
- c. The MEXA 8x8 was difficult to control in a tight turn. Because the front unit of the MEXA 8x8 was lighter than the second and third units, there was a tendency for the front unit to be pushed sideways. To correct this problem, the first-joint pitch control had to be used during a turn to transfer some weight from the second unit to the first.

PART IV: COMPARATIVE EVALUATION OF VEHICLE PERFORMANCE

107. The performances of the military and MEXA vehicles were compared on the basis of the results presented in Part III. These results include the experimentally determined VCI_{1t} and VCI_{50}, drawbar pull-speed relations, drawbar pull-soil strength relations, towed motion resistance-RCI relations, maximum speed-RCI relations, turning radius-speed relations, and force required in turning-soil strength relations. Except for the VCI_{50} determinations, all performance correlations were made on the basis of one-pass performance. The similar relations developed for each vehicle are compared and discussed in the following paragraphs.

VCI Tests

108. Tests to determine the minimum soil strength that would permit the vehicles to complete one pass (VCI_{1t}) and 50 passes (VCI_{50}) in a straight-line path on level fine-grained soil revealed the following results:

Vehicle	Experimental VCI_{50}	Experimental VCI_{1t}
XM410E1	32	18
M35A2 (mod)	56	27
M113	29	15
MEXA 10x10	18	7
MEXA 8x8	23	11
MEXA track	21	7

109. The experimental VCI_{1t} and VCI_{50} for the test vehicles showed that on the basis of "go-no go" for one pass and 50 passes in fine-grained soil, the three MEXA vehicles were superior in performance to the three military vehicles.

Drawbar Pull Tests

Drawbar pull-speed relations

110. The drawbar pull-speed curves for military and MEXA vehicles

are shown in plates 3 and 4, respectively. A comparison of performance in terms of drawbar pull divided by vehicle weight (D/W) versus speed shows that on soils strong enough for all vehicles to operate, the MEXA vehicles generally developed higher D/W values between 0 and about 2 mph. Beyond 2 mph the military vehicles developed higher D/W values. The data for these tests show that the military vehicles could not develop enough force to produce 100 percent slip between their traction elements and pavement or the firmer soil strength. The MEXA vehicles in their lower gear apparently had ample power to produce 100 percent slip on all test surfaces.

Drawbar pull-soil strength relations

111. A summary of $(D/W)_{opt}$ versus soil strength curves for the six test vehicles is presented in plate 14. The curves show that the traction performances in terms of $(D/W)_{opt}$ for the MEXA vehicles are superior to those of the three military vehicles. From the minimum soil strength values, $(D/W)_{opt}$ for each of the military vehicles increased rapidly to about 50 RCI, beyond which little change occurred with increased soil strength. The $(D/W)_{opt}$ for each of the MEXA vehicles increased rapidly up to about 40 RCI. Beyond 40 RCI, the $(D/W)_{opt}$ for each of the MEXA vehicles increased little with increase in soil strength.

Towed Motion Resistance

112. Effects of soil strength on one-pass towed motion resistance for the test vehicles are shown in plate 15. Motion resistance divided by vehicle weight (R/W) is plotted versus 0- to 6-in. RCI. Performance curves in these plots indicate that for the soil strengths tested, R/W for the MEXA wheeled vehicles was less than R/W for the wheeled and tracked military vehicles. On soil strengths less than about 40 RCI, R/W for the MEXA track was generally less than R/W for the wheeled and tracked military vehicles. Above about 40 RCI the MEXA track's R/W was generally greater than that of the M113 and of the XM410E1 but less than that of the M35A1 (mod).

Speed Tests

113. Curves showing the effect of soil strength on maximum vehicle

speed on a level surface for the test vehicles are presented in plate 16. The plot shows one-pass maximum speed versus 0- to 6-in. RCI. A comparison of curves indicates that the performance of the MEXA vehicles as a group was superior to that of the military vehicles on soil strengths between 7 and 21 RCI. The M113 outperformed the MEXA track except in very soft soils below an RCI of about 20. The MEXA wheeled vehicles outperformed the M113 except on pavement. The XM410E1 outperformed all MEXA vehicles except in the very soft soils, below RCI's of 20-30. The M35A2 (mod) outperformed the MEXA wheeled vehicles in firm soils (RCI 70-80) and on pavement, and outperformed the MEXA track in soils firmer than RCI 40. On pavement the speed of the conventional military wheeled vehicles was about 2.5 times greater than the speed of the MEXA wheeled vehicles and the speed of the military tracked vehicle about 2 times greater than that of the MEXA track.

Maneuver Tests

Turning radius-speed relations

114. A summary of relations developed showing the effects of speed and soil strength on turning radius for the test vehicles is presented in plate 17. The plots show vehicle speed versus turning radius for each test vehicle on a range of soil strengths (indicated on the plots). As previously discussed (paragraph 88), for the range of soil strengths tested, soil strength appeared to have little effect on the vehicle's turning radius. A study of these relations indicates that at a given speed the military vehicles have smaller turning radii than the MEXA 10x10 and the MEXA track. The MEXA 8x8 turning radius was greater than that of the XM410E1, about the same as the M35A2 (mod), and greater than the M113.

Turning force-soil strength relations

115. The effects of soil strength on force required in a turn (F_{T}/W at MSA - 5 deg) for the XM410E1, M35A2 (mod), MEXA 10x10, and MEXA track are shown in plate 18. The performance of the MEXA 10x10 was about the same as that of the XM410E1 and was better than that of the M35A2 (mod). The performance of the MEXA track was the poorest of the four vehicles in this test.

PART V: SUMMARY OF TEST RESULTS, AND RECOMMENDATIONS

Summary of Test Results

116. Results of this investigation are summarized below.

a. VCI's established for the six test vehicles were:

Vehicle	Experimental VCI_{50}	Experimental VCI_{1t}
XM410E1	32	18
M35A2 (mod)	56	27
M113	29	15
MEXA 10x10	18	7
MEXA 8x8	23	11
MEXA track	21	7

(See paragraphs 39 and 50 and plates 1 and 2.)

b. The MEXA vehicles were superior to the military vehicles in terms of VCI_{1t} and VCI_{50} (paragraphs 108 and 109).

c. The best overall one-pass critical-layer criteria determined from field tests for the six vehicles were: the 0- to 6-in. layer was considered to be the normal critical layer unless the RCI of the 6- to 12-in. layer was less than that of the 0- to 6-in. layer, in which case the 6- to 12-in. layer was considered to be the critical layer (paragraph 42).

d. The soil strength parameter that showed best overall correlation with drawbar pull, motion resistance, speed, and maneuver test results was the 0- to 6-in. RCI (paragraph 51).

e. On soil strong enough for all vehicles to operate, the MEXA vehicles generally developed higher maximum D/W values than did the military vehicles for speeds less than about 2 mph; at speeds greater than 2 mph the military vehicles developed the higher maximum D/W (paragraphs 54 and 110 and plates 3 and 4).

f. MEXA vehicle performance in terms of $(D/W)_{opt}$ was superior to that of the military vehicles, thus indicating a greater traction efficiency. For the soil strengths tested, the military vehicles developed maximum $(D/W)_{opt}$ of between 0.50 and 0.60 and the MEXA vehicles developed maximum $(D/W)_{opt}$ of between 0.60 and 0.80 (paragraphs 57-64 and 111 and plate 5).

g. Towed motion resistance (R/W) was less for the MEXA wheeled vehicles than that for the wheeled and tracked

military vehicles (paragraph 112). On soils of strengths below about 40 RCI the R/W of the MEXA track was lower than the R/W's of the military vehicles (paragraphs 65-69 and plate 6). Above about 40 RCI the R/W of the MEXA track was generally greater than the R/W's of the M113 and the XM410E1 but less than that of the M35A2 (mod).

h. As soil strength increased from minimum values of VCI_{1t}, vehicle speed increased, with the vehicles developing a maximum speed on pavement. The performance curves indicate that the speeds of the six test vehicles at their respective VCI_{1t}'s appear to be about 2.5 mph. Maximum speeds on pavement were: XM410E1, 53.0 mph; M35A2 (mod), 52.3 mph; M113, 30.2 mph; MEXA 10x10, 22.5 mph; MEXA 8x8, 22.9 mph; and MEXA track, 16.2 mph (paragraphs 76-81 and plate 9).

i. MEXA vehicles do what they were designed to do--perform better on soft soils than military vehicles. However, on firm soil and on pavement, the three military vehicles performed better than the MEXA's (paragraph 113).

j. For the range of soil strengths and speeds tested, speed appeared to be a more influential factor than soil strength in affecting the vehicles' ability to make a turn (paragraphs 84 and 114).

k. The military vehicles had smaller turning radii than the MEXA 10x10 and MEXA track at the same speed for the range of soil strengths tested. The MEXA 8x8 turning radius was greater than that of the XM410E1, about the same as the M35A2 (mod), and greater than the M113. (Paragraph 114 and plate 17.)

l. Force (F_T/W) developed during vehicle turning action was slightly greater than straight-line F_T/W up to about 5 deg less than maximum steering angle. Beyond maximum steering angle minus 5 deg, force usually increased sharply (paragraph 86).

m. The F_T/W required in a turn for the MEXA 10x10 was about the same as that for the XM410E1 and was less than that for the M35A2 (mod). The MEXA track required the highest F_T/W of the four vehicles tested (paragraph 115).

n. The minimum soil strength required for maneuvering appears to be the same as VCI_{1t} for the XM410E1, M35A2 (mod), MEXA 8x8, MEXA 10x10, and MEXA track. Additional test data are needed to determine the minimum soil strength on which the M113 can maneuver. (See paragraphs 93 and 94.)

o. The MEXA's articulated steering and inching systems contributed little to their abilities to extricate themselves from immobilizations caused by soft soil (paragraphs 96-102).

Recommendations

117. It is recommended that:

a. Further analyses of the data be made. The analyses of data presented herein were limited to meet the stated objectives; however, additional test data were collected to permit comparative evaluation of test procedures and the development of other soil-vehicle relations that may lead to improved soil-vehicle relations or simpler testing procedures.

b. The MEXA vehicles be repaired and reconditioned for use in other test programs.

c. Additional tests be conducted in fine-grained soils to complete testing of vehicles on desired soil strengths that were not tested because of mechanical failures of vehicles. It is also recommended that tests be conducted on soils ranging in strength from 60 to 300+ RCI.

d. Tests be conducted to refine testing procedures for determining maneuvering and slope climbing capabilities and effects of slippery surface on vehicle performance.

e. Tests be conducted to determine the performance of MEXA vehicles on sands in desert environments.

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Table 1

Vehicle Data

Vehicle	Vehicle Weight, lb Empty	Vehicle Weight, lb Payload	Vehicle Weight, lb Test	Wheel and Tire Data: Size*	Nominal Width in.	Rim Diam in.	Wheel Diam in.	No. of Wheels	No. of Axles	Avg Inflation Pressure psi	Avg Deflection %	Total Contact Area sq in.	Avg Contact Pressure psi	Ply Rating	Ground Clearance in.	Brake Horsepower	Transmission Type
Preliminary Tests																	
2-1/2-ton [illegible] truck	11,504	7000	18,504	14x18	14	18	40	8	4	13.0	25.0	1042	17.8	6	15.0	154	Hydraulic
2-1/2-ton GOER 10x10	1[illegible],030	5000	18,030	42x40-16A	[illegible]	16	42	10	5	3.0	31.6	5495	3.3	4	11.5	214	Hydraulic
2-1/2-ton MEDA [illegible]	14,013	5000	19,013	46x31-16A	31	16	48	8	4	5.2	27.9	3338	5.7	4	12.0	214	Hydraulic
Comprehensive Tests																	
2-1/2-ton [illegible] truck	11,504	5000	16,504	14.00-18	14	18	40	8	4	12.2	25.0	975	16.9	6	15.0	154	Hydraulic
2-1/2-ton M35A2 (mod), 6x6 truck	13,225	5000	18,225	11.00-20	11	20	42	6	3	20.1	25.0	664	27.4	12	12.5	220	Mechanical
2-1/2-ton GOER 10x10	1[illegible],030	[illegible]000	1[illegible],030	42x40-16A	40	16	42	10	5	7.3	20.0	2654	6.8	4	11.5	214	Hydraulic
2-1/2-ton MEDA [illegible]	14,013	5000	19,013	46x31-16A	31	16	48	8	4	9.0	20.0	2201	8.6	4	12.0	214	Hydraulic

Vehicle	Vehicle Weight, lb Empty	Vehicle Weight, lb Payload	Vehicle Weight, lb Test	Track Data: Contact Length in.	Contact Width in.	Shoe Length in.	Total Contact Area (All Tracks) sq in.	Avg Contact Pressure psi	No. of Bogies Per Side	Ground Clearance in.	Brake Horsepower	Transmission Type
Preliminary Tests												
M113 armored personnel carrier (APC)	18,[illegible]00	5[illegible]00	24,200	105	15	6	3150	7.5	5	16.0	202	Hydraulic
MEDA (tracked)	14,[illegible]80	5000	19,680	85 and 104	20	4	7560	2.6	9	12.0	214	Hydraulic
Comprehensive Tests												
M113 armored personnel carrier (APC)	1[illegible],[illegible]00	4000	22,[illegible]00	105	15	6	3150	7.2	5	16.0	202	Hydraulic
MEDA (tracked)	14,[illegible]50	5000	19,[illegible]50	85 and 104	20	4	7560	2.6	9	12.0	214	Hydraulic

* From manufacturer's specifications.

Table 2

Summary of Soil Data and VCI Test [illegible]

Item No.	Site Location	Test No.	Immobilization Yes or No	Pass No.	Data Pass No.	Cone Index at Depths, in. 0	1	2	3	4	5	6	9	12	15	18	24	30	36	Avg Cone Index of Layers, in. 0-6	6-12	12-18	Remolding Index of Layers, in. 0-6	6-12	12-18	Rating Cone Index of Layers, in. 0-6	6-12	12-18	Moisture Con[tent] (% Dry Wt) of Lay[ers] 0-1	0-6	6-1[2]
																							Military Vehicles								
																							2-1/2-Ton XM410E1, 8x8 Truck, Test Weigh[t]								
1	Chotard Lake	[illegible]	Yes	[illegible]	0	20	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	34	35	34	--	--	45	47	35	0.74	0.76	0.63	33	36	22	71.0	53.5	67
					1	41	--	--	52	--	--	41	[illegible]	32	32	34	34	--	--	45	40	33									
					10	[illegible]	--	--	47	--	--	34	31	31	32	34	32	--	--	39	32	32									
					20	[illegible]	--	--	28	--	--	24	[illegible]	30	29	28	29	--	--	29	27	29									
[illegible]		[illegible]	Yes	14	0	[illegible]	--	--	[illegible]	--	--	[illegible]	50	30	32	28	36	--	--	46	50	33	0.70	0.80	0.60	32	40	20	65.7	51.6	58
					1	[illegible]	--	--	[illegible]	--	--	[illegible]	41	34	29	30	34	--	--	48	45	31									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	28	30	32	34	35	--	--	42	31	32									
					14																										
3		[illegible]	No	--	0	[illegible]	--	--	[illegible]	--	--	81	81	[illegible]	71	76	92	--	--	68	80	75	0.82	0.78	0.82	56	62	62	60.8	61.9	4[illegible]
					1	[illegible]	--	--	[illegible]	--	--	[illegible]	81	82	71	76	81	--	--	73	83	76									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	80	[illegible]	[illegible]	[illegible]	--	--	74	[illegible]	81									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	78	[illegible]	[illegible]	--	--	[illegible]	[illegible]	80									
4		[illegible]	No	--	0	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	68	68	80	--	--	36	[illegible]	64	0.74	0.78	0.76	27	38	49	143.9	84.7	50
					1	[illegible]	--	--	[illegible]	--	--	62	[illegible]	62	[illegible]	68	81	--	--	44	67	66									
					10	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	74	76	76	82	--	--	52	70	75									
					[illegible]	[illegible]	--	--	62	--	--	[illegible]	[illegible]	70	[illegible]	[illegible]	84	--	--	57	74	71									
[illegible]		[illegible]	Yes	[illegible]	0	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	32	32	34	--	--	[illegible]	[illegible]	33	0.71	0.[illegible]	0.58	29	29	19	107.0	69.8	56.
					1	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	32	30	32	[illegible]	--	--	39	[illegible]	31									
					[illegible]	[illegible]	--	--	47	--	--	[illegible]	[illegible]	41	41	32	30	--	--	41	29	31									
																							2-1/2-Ton XM410E1, 8x8 Truck, Test Weigh[t]								
[illegible]	Chotard Lake	[illegible]	No	--	[illegible]	[illegible]	--	--	[illegible]	--	--	44	[illegible]	[illegible]	[illegible]	54	[illegible]	--	--	41	46	53	0.[illegible]	0.82	0.75	34	38	40	65.6	61.1	54.
					1	70	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	70	--	--	[illegible]	[illegible]	55									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]									
[illegible]		[illegible]	Yes	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	40	[illegible]	[illegible]	[illegible]	--	--	[illegible]	28	[illegible]	0.[illegible]	0.72	0.76	17	20	30	95.5	76.8	66.
					1	[illegible]	--	--	34	--	--	[illegible]	[illegible]	[illegible]	[illegible]	52	[illegible]	--	--	[illegible]	37	47									
					[illegible]	[illegible]	--	--	[illegible]	--	--	47	44	44	47	[illegible]	47	--	--	[illegible]	42										
[illegible]		[illegible]	Yes	1	[illegible]	11	--	--	[illegible]	--	--	30	[illegible]	22	[illegible]	[illegible]	[illegible]	--	--	17	[illegible]	--	0.[illegible]0	0.[illegible]	0.[illegible]3	10	17	21	135.5	84.7	61.
					[illegible]																										
[illegible]		[illegible]	No	--	[illegible]	[illegible]	--	--	[illegible]	--	--	30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	43	0.7[illegible]	0.[illegible]	0.[illegible]4	21	[illegible]	[illegible]	128.2	69.6	56.
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	42	40									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	44	[illegible]									
10	Mars [illegible] site [illegible]	[illegible]	Yes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	44	44	[illegible]	[illegible]	43	--	--	47	47	[illegible]	0.73	0.7[illegible]	0.6[illegible]	34	[illegible]	24	19.9	26.5	48.
					1	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	39	41	[illegible]	--	--	[illegible]	51	40									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	41	42	[illegible]	[illegible]	[illegible]	--	--	[illegible]	41	44									
					[illegible]	[illegible]	--	--	[illegible]	--	--	41	[illegible]	[illegible]	41	[illegible]	[illegible]	--	--	41	[illegible]	[illegible]									
					[illegible]	[illegible]	--	--	41	--	--	[illegible]	[illegible]	[illegible]	41	42	[illegible]	--	--	37	47	40									
[illegible]	Mars [illegible] site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	0.7[illegible]	0.72	0.6[illegible]	21	22	16	21.4	28.1	35.
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	41	--	--	[illegible]	[illegible]	[illegible]									
[illegible]	Mars [illegible] site [illegible]	[illegible]	No	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	0.[illegible]	0.[illegible]0	0.[illegible]4	[illegible]	37	32	20.4	[illegible]	[illegible]
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	70	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]									
																							[illegible]-1/[illegible]-Ton M[illegible] A2 [illegible], [illegible] Truck, Test Wei[ght]								
[illegible]	[illegible] Lake	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	0.[illegible]	0.[illegible]	0.79	[illegible]	[illegible]	[illegible]	71.8	64.0	49.[illegible]
[illegible]		[illegible]	[illegible]	--	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	[illegible]	[illegible]	[illegible]	61.2	64.4	44.1
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	0.[illegible]	0.77	0.[illegible]	37	[illegible]	[illegible]0	80.1	[illegible]	47.[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	0.[illegible]	0.[illegible]	[illegible]	[illegible]	47	110.3	[illegible]9.3	54.[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	0.[illegible]	0.[illegible]	0.70	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	[illegible]	[illegible]	[illegible]	[illegible].2	[illegible]	[illegible]4.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	[illegible]	[illegible]	22	[illegible]	[illegible]	[illegible]

(Continued)

[illegible] from shear stress-normal stress curves at normal ground contact pressure.

A

Table 2

Summary of Soil Data and VCI Test Results

Rating Cone Index of Layers, in. 0-6	6-12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph* Vane c	Vane φ°	Vane S_v	Rubber a	Rubber φ°	Rubber S_r	Avg Rut Depth in.	Remarks
Military Vehicles																	
1/2-Ton XM410E1, 8x8 Truck, Test Weight 18,504 lb																	
33	36	22	[illegible]1.0	53.5	67.0	52.0	68.0	76.7	68.0	0.2	8	2.7	1.1	4	2.3	-- 1.6 6.0 11.6	Vehicle dragged on mud buildup between ruts on 10th pass. Had difficulty on 17th pass and extreme difficulty on 20th pass. Vehicle considered to be immobilized on 22d pass
32	40	20	[illegible]3.7	51.6	58.0	61.6	69.8	63.8	63.2	0.5	8	3.3	0.7	6	2.6	-- 2.2 7.6 10.8	Vehicle dragged on mud buildup between ruts on 8th pass and became immobilized on 14th pass
56	62	62	60.8	51.9	42.6	45.9	60.5	73.5	68.7	3.6	20	10.4	2.2	14	6.5	-- 0.1 1.8 2.3	Vehicle began dragging on mud buildup between ruts on 44th pass, but completed 50 passes with ease
27	38	49	143.9	84.7	50.2	35.8	47.4	64.3	76.2	2.9	10	6.1	2.1	8	4.5	-- 2.2 5.2 10.1	Vehicle began dragging on mud buildup between ruts on 6th pass and had some difficulty making 39th pass. Vehicle completed 50 passes with difficulty
29	29	19	107.0	69.8	56.1	51.4	55.0	65.8	66.6	0.2	11	3.7	0.7	4	2.0	-- 1.8 8.0	Vehicle began dragging on mud buildup between ruts on 3d pass. There was some wheel slip on 5th pass. Vehicle became immobilized on 7th pass
/2-Ton XM410E1, 8x8 Truck, Test Weight 16,504 lb																	
34	38	40	65.6	61.1	54.7	36.8	55.4	63.8	83.2	4.0	26	12.2	0.0	35	11.6	-- 1.7 6.6	Vehicle began dragging on mud buildup between ruts on 45th pass, but had no difficulty completing 50 passes
17	20	30	95.5	76.8	66.6	37.9	51.2	58.5	80.7	4.3	20	10.3	0.9	25	8.6	-- 3.8 11.8	Vehicle began dragging on mud buildup between ruts on 3d pass. By 5th pass vehicle was dragging entire test lane. On 14th pass vehicle had extreme difficulty and was considered to be immobilized
10	17	21	135.5	84.7	61.5	46.3	48.6	62.5	70.9	2.7	6	4.4	1.0	13	4.8	-- 10.0	Vehicle entered test lane and became immobilized on 1st pass
21	2[illegible]	28	128.2	69.6	56.2	43.5	48.8	64.4	74.7	2.9	31	12.0	1.8	17	7.0	-- 3.2 15.4	Vehicle began dragging on mud buildup by 10th pass, and was dragging entire test lane by 20th pass and having some difficulty. Differential caused mechanical difficulty on 35th pass, but vehicle completed 14 passes before test was stopped
34	3[illegible]	24	19.9	26.5	48.2	87.8	89.8	68.9	47.6	3.0	24	10.6	1.4	23	8.5	-- 2.0 7.4 9.9 10.7	Undercarriage on left side was dragging on 7th pass. On 14th pass vehicle became immobilized in reverse gear due to lack of power to slip wheels. Vehicle traveled in forward gear through the lane and reentered test lane at opposite end. Passes 14, 15, and 16 were completed in forward gear. Vehicle became immobilized on 17th pass in forward gear
21	22	16	21.4	28.1	35.8	60.9	86.4	79.9	62.0	3.8	24	11.4	0.8	28	9.8	-- 4.7 9.1	Undercarriage began dragging at start of 4th pass in reverse gear. Vehicle continued through test lane, became immobilized near end of lane on 4th pass, and could not go forward
56	37	32	20.4	36.3	66.1	67.6	75.0	60.0	59.2	2.2	31	12.3	1.2	30	11.0	-- 1.8 2.9 4.4	Vehicle completed 50 passes with ease
Ton M35A2 (mod), 6x6 Truck, Test Weight 1[illegible],225 lb																	
34	46	46	71.8	64.0	49.7	[illegible]	[illegible]	[illegible]	73.0	4.3	27	18.1	2.2	22	13.2	-- 1.9 12.6	Vehicle began dragging on mud buildup by 7th pass and had some wheel slip on 34th pass. Vehicle had difficulty on 37th pass; difficulty increased until vehicle became immobilized on 41st pass
48	58	55	61.2	64.4	44.4	48.4	59.0	73.0	[illegible]	4.6	34	23.0	0.2	34	18.6	-- 2.0 11.8	Vehicle began dragging on mud buildup by 10th pass and had some difficulty on 46th pass. Vehicle was able to complete 50 passes
37	44	50	60.1	59.4	47.[illegible]	46.5	62.8	72.[illegible]	71.0	2.4	39	24.4	0.0	41	18.4	-- 2.4 13.9	Vehicle began dragging on mud buildup by 9th pass and had difficulty on 41st pass; difficulty increased with each subsequent pass. Vehicle had extreme difficulty on 4[illegible]th pass and became immobilized on 47th pass
24	30	47	110.3	69.3	54.8	41.1	[illegible]	63.4	[illegible]	2.1	[illegible]	[illegible]	0.3	[illegible]	13.[illegible]	-- 14.0	Vehicle began dragging slightly on [illegible] pass and was dragging entire lane by 4th pass. Vehicle became immobilized on [illegible] pass in forward
14	2[illegible]	31	113.6	50.6	52.6	45.3	48.6	68.1	79.1	[illegible]	20	13.8	1.[illegible]	[illegible]	9.[illegible]	-- 13.0	Vehicle proceeded into test lane and became immobilized on 1st pass
26	[illegible]	41	75.2	65.3	54.0	39.6	[illegible]	67.6	80.[illegible]	4.[illegible]	21	15.2	0.8	[illegible]	14.0	-- 14.0	Vehicle began dragging on mud buildup on [illegible] pass. By [illegible] pass entire vehicle undercarriage was dragging heavily. Vehicle had difficulty on [illegible] pass and became immobilized on [illegible] pass
2[illegible]	[illegible]	22	23.[illegible]	29.6	[illegible]	71.0	[illegible]	[illegible]	[illegible]							--	Vehicle became immobilized on [illegible] pass

(Continued)

(1 of [illegible] sheets)

[illegible]t pressure.

B

Table 2 (Continued)

Item No.	Site Location	Test No.	Immobilization Yes or No	Pass No.	Data Pass No.	CI 0	CI 1	CI 2	CI 3	CI 4	CI 5	CI 6	CI 9	CI 12	CI 15	CI 18	CI 24	CI 30	CI 36	Avg CI 0-6	Avg CI 6-12	Avg CI 12-18	RI 0-6	RI 6-12	RI 12-18	RCI 0-6	RCI 6-12	RCI 12-18	Moisture 0-1	Moisture 0-6
																							Military Vehicles (Con							
																							2-1/2-Ton M35A2 (mod), 6x6 Truck, Test Wei							
20	Carson Sink site 5	[illegible]	Yes	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	71	64	62	58	[illegible]	57	57	62	--	--	61	59	57	0.88	0.67	0.60	53	40	34		
					1	114	--	--	121	--	--	82	71	63	67	68	73	--	--	106	72	66								
					[illegible]	177	--	--	[illegible]	--	--	83	[illegible]	62	63	72	67	--	--	122	70	66								
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	72	[illegible]	80	82	--	--	151	77	74								
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	78	80	88	--	--	130	78	78								
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	58	[illegible]	62	--	--	97	62	58								
21	Carson Sink site 2	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	43	42	41	38	41	--	--	45	44	40	0.66	0.76	0.51	30	33	20	20.8	27.4
					1	[illegible]	--	--	[illegible]	--	--	41	18	18	25	20	43	--	--	36	22	21								
					4	[illegible]	--	--	[illegible]	--	--	[illegible]	28	28	29	39	54	--	--	27	25	32								
22	Carson Sink site [illegible]	[illegible]	Yes	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	33	38	40	--	--	36	30	33	0.74	0.72	0.65	27	22	21	21.4	28.1
23	Carson Sink site 4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	72	51	[illegible]	[illegible]	[illegible]	58	58	55	[illegible]	63	--	--	67	59	57	0.67	0.64	0.49	45	38	26	18.7	36.8
					1	[illegible]	--	--	117	--	--	[illegible]	72	[illegible]	[illegible]	70	70	--	--	[illegible]	77	67								
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	80	71	[illegible]	[illegible]	83	--	--	138	80	73								
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	68	68	74	72	--	--	129	69	70								
					[illegible]	[illegible]	--	--	[illegible]	--	--	51	[illegible]	61	[illegible]	49	[illegible]	--	--	62	[illegible]	55								
24	Carson Sink site 4	[illegible]	Yes	41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	78	[illegible]	[illegible]	[illegible]	66	[illegible]	--	--	80	70	66	0.74	[illegible]	0.57	59	48	38	20.1	36.7
					1	[illegible]	--	--	[illegible]	--	--	[illegible]	100	102	120	130	[illegible]	--	--	[illegible]	[illegible]	117								
					[illegible]	[illegible]	--	--	[illegible]	--	--	122	113	[illegible]	[illegible]	[illegible]	[illegible]	--	--	178	116	[illegible]								
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	110	120	117	108	117	--	--	144	110	115								
					51	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	64	[illegible]	--	--	85	68	66								
[illegible]	Carson Sink site [illegible]	[illegible]	[illegible]	41	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	74	[illegible]	[illegible]	0.90	0.52	0.44	67	40	38	32.8	77.2
					1	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	107	--	--	[illegible]	81	89								
					41	[illegible]	--	--	70	--	--	[illegible]	[illegible]	[illegible]	102	102	102	--	--	67	[illegible]	101								
[illegible]	Carson Sink site [illegible]	[illegible]	[illegible]	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	114	[illegible]	[illegible]	[illegible]	--	--	79	102	120	1.12	0.58	0.60	88	59	72	16.9	51.2
					1	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	114	117	--	--	[illegible]	103	110								
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	111	[illegible]	100	[illegible]	[illegible]	--	--	[illegible]	115	102								
																									M113 APC, Full Tracked, Test We					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	0.44	[illegible]	0.42	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	0.42	0.40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
																										[illegible], Full Tracked, Test [illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	--	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

A

ble 2 (Continued)

...18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph Vane c	ϕ^o	S_v	Sheargraph Rubber a	ϕ^o	S_r	Avg Rut Depth in.	Remarks
...ry Vehicles (Continued)															
...6 Truck, Test Weight 18,225 lb (Continued)															
[illegible]			57.6	81.2		65.3	52.4	3.0	25	17.8	1.0	29	16.4	-- 2.8 4.3 5.6 8.4 9.8	Undercarriage was dragging on 19th pass. Vehicle was dragging entire lane by 24th pass. A large amount of mud had accumulated on tires and axles by 42d pass. Vehicle became immobilized on 46th pass
[illegible]	20.8	27.4	46.0	73.4	91.7	71.6	54.2	4.0	27	18.2	0.5	30	16.5	-- 5.3 12.1	Undercarriage was dragging on 2d pass. Vehicle had difficulty making 3d pass and became immobilized on 4th pass
[illegible]	21.4	26.1	35.8	60.9	86.4	79.9	62.0	3.8	24	16.2	0.8	28	15.6	--	Vehicle became immobilized on 1st pass
[illegible]	18.7	36.8	64.7	85.0	82.3	60.2	48.6	4.5	26	18.1	0.7	34	19.0	-- 3.1 5.2 7.4 9.6	Undercarriage was dragging on 23d pass. Vehicle became immobilized on 33d pass
[illegible]	20.1	36.7	65.3	66.6	76.2	59.6	58.2	3.5	28	18.3	1.8	30	17.8	-- 2.6 4.1 6.0 8.0	Undercarriage was dragging on 23d pass. Vehicle became immobilized on 41st pass
[illegible]	32.8	77.2	135.4	115.9	55.0	36.1	40.4	5.4	39	27.7	1.0	34	19.6	-- 1.2 8.6	Undercarriage began dragging on soil buildup between ruts on 10th pass and was dragging entire test lane by 25th pass. Vehicle became immobilized on 31st pass
[illegible]	16.9	51.2	103.1	108.3	67.1	40.6	42.7	2.8	42	27.8	0.4	38	21.8	-- 1.2 5.3	Vehicle completed 50 passes with ease
... Tracked, Test Weight 24,200 lb															
	52.5	42.5	36.2	36.2	77.2	84.3	85.1	3.8	13	5.6	0.6	17	2.9	-- --	Vehicle became immobilized on 1st pass. Undercarriage was dragging
	34.6	35.0	33.6	34.1	77.0	85.4	81.0	7.5	32	12.5	0.8	33	6.0	-- 1.9 9.4 13.8	Vehicle began dragging on 8th pass and was dragging entire test lane by 15th pass. Difficulty increased with each subsequent pass. Both tracks were slipping and vehicle became immobilized on 46th pass
	44.2	37.1	32.4	34.6	80.8	[illegible]	84.2	[illegible]	[illegible]	13.5	0.0	32	[illegible]	-- 1.4 11.5 11.9	Vehicle began dragging on 10th pass and was having difficulty on 12th pass. Vehicle was dragging entire lane by 14th pass and became immobilized on 25th pass
	47.6	47.5	40.3	37.1	64.8	79.0	81.8	17.2	20	20.0	1.2	31	[illegible]	-- 3.[illegible] 10.2	Vehicle began dragging on 4th pass and was dragging entire lane by 7th pass. Both tracks were slipping and vehicle became immobilized on 8th pass
	[illegible]	46.2	37.2	36.0	74.4	81.3	83.0	9.7	[illegible]	11.4	0.4	33	[illegible]	-- 3.2 14.[illegible]	Vehicle began dragging on 4th pass and was dragging entire lane by [illegible]th pass. Both tracks were slipping and vehicle became immobilized on 7th pass
	[illegible]2.7	47.1	41.2	50.7	73.6	77.[illegible]	[illegible]7.9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible] [illegible]	Vehicle began dragging on [illegible] pass and was dragging entire lane by [illegible] pass. Vehicle had extreme difficulty on [illegible] pass and became immobilized on [illegible] pass
... Tracked, Test Weight 22,[illegible]00 lb															
	74.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.2	[illegible]	[illegible]	-- [illegible] [illegible]	Vehicle was dragging slightly on 15th pass, but completed 50 passes with little difficulty
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40	[illegible]	-- [illegible] [illegible]	Vehicle was dragging slightly on [illegible] pass and by [illegible] pass was dragging entire test lane. Difficulty increased with each subsequent pass and on pass [illegible] vehicle became immobilized
	[illegible]4.0	[illegible]	[illegible]7.7	[illegible]	[illegible]	[illegible]5.2	[illegible]4.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible]	Vehicle began dragging slightly on [illegible] pass [illegible] and by [illegible] pass vehicle was dragging entire lane. Vehicle was having some difficulty after [illegible] pass. Vehicle had difficulty staying in ruts on pass [illegible] and cut into sides of ruts at several places along lane and became immobilized but was able to extricate itself under own power. Vehicle was run on soil nearby that was of higher strength to remove mud and reentered lane for [illegible]th pass but could not stay in ruts and became immobilized. Vehicle considered to be immobilized on [illegible]th pass
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible] [illegible]	Undercarriage began dragging on [illegible] pass. Vehicle had extreme difficulty on [illegible] pass and became immobilized on [illegible] pass in reverse
	[illegible]	[illegible]	41.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible] 4.4 [illegible] [illegible]	Undercarriage began dragging on [illegible] pass and was dragging entire lane by [illegible] pass. Vehicle had extreme difficulty on [illegible] pass and became immobilized on [illegible] pass

65 B

Table 2 (Continued)

Item No.	Site Location	Test No.	Immobilization Yes or No	Immobilization Pass No.	Data Pass No.	Cone Index at Depths, in. 0	1	2	3	4	5	6	9	12	15	18	24	30	36	Avg Cone Index of Layers, in. 0-6	6-12	12-18	Remolding Index of Layers, in. 0-6	6-12	12-18	Rating Cone Index of Layers in. 0-6	6-12	12-18	Moisture Co[ntent] (% Dry Wt) of La[yers] 0-1	0-6	6-
																							Military Vehicles (Continued)								
																							M113 APC, Full Tracked, Test Weight 22,600								
38	Carson Sink site [illegible]	[illegible]	Yes	44	0	37	47	57	66	73	68	62	50	38	34	42	52	--	--	59	50	38	0.80	0.74	0.59	47	37	22	17.9	26.5	4[illegible]
					1	91	--	--	87	--	--	59	45	38	39	47	62	--	--	76	47	41									
					[illegible]	77	--	--	71	--	--	52	38	37	42	43	58	--	--	67	42	41									
					20	69	--	--	69	--	--	40	35	38	40	47	64	--	--	56	38	42									
					47	47	--	--	56	--	--	36	40	51	60	58	60	--	--	46	42	56									
39	Carson Sink site 4	83	No	--	0	45	74	[illegible]	94	78	68	64	58	56	54	54	56	--	--	73	59	55	0.85	0.60	0.54	62	39	30	20.4	36.3	6[illegible]
					1	138	--	--	95	--	--	75	65	62	59	62	62	--	--	103	67	61									
					50	182	--	--	79	--	--	67	53	50	54	58	61	--	--	109	57	54									
40	Four Mile Flat site [illegible]	139	Yes	1	0	8	16	21	25	22	21	19	17	21	21	28	37	--	--	19	19	23	0.56	0.72	0.59	11	14	14	44.1	40.5	5[illegible]
					1	[illegible]	--	--	11	--	--	19	34	28	31	34	--	--	--	13	24	31									
41	Four Mile Flat site [illegible]	140	Yes	1	0	11	[illegible]	14	16	18	14	16	21	23	27	27	31	--	--	15	20	2[illegible]	0.56	0.66	0.64	8	13	17	44.0	52.2	4[illegible]
					1																										
																							MEXA Vehicles								
																							2-1/2-Ton MEXA, 10x10 Truck, Test Weight								
42	WES	1	Yes	1	0	19	--	--	8	--	--	7	6	7	9	11	16	23	47	11	7	9	0.56	0.46	0.50	6	3	4	84.8	62.8	5[illegible]
					1																										
43		2	Yes	10	0	48	--	--	44	--	--	34	20	8	15	13	122	282*	202*	35	21	17	0.78	0.45	0.50	27	9	8	31.5	44.3	4[illegible]
					1																										
					10	54	--	--	18	--	--	12	9	8	10	42	258*	279*	286*	10	10	20									
					22	49	--	--	20	--	--	12	10	9	44	198*	278*	294*	286*	27	10	84*									
					30	21	--	--	10	--	--	12	11	13	54	166*	278*	293*	296*	14	12	78*									
44		[illegible]	Yes	40	0	42	--	--	46	--	--	34	22	20	21	24	80	156	294*	35	23	22	0.78	0.54	0.52	27	12	11	44.7	44.2	4[illegible]
					1	66	--	--	40	--	--	30	22	20	18	18	96	171	290*	45	24	19									
					40	28	--	--	24	--	--	21	18	16	26	77	164	278*	290*	24	15	4									
45		[illegible]	Yes	[illegible]	0	16	--	--	12	--	--	11	10	10	11	12	20	27	37	13	10	11	0.42	0.48	0.49	5	[illegible]	5	62.9	52.8	4[illegible]
					1	12	--	--	10	--	--	8	8	8	12	16	40	37	48	10	8	12									
46		11	Yes	[illegible]	0	20	--	--	20	--	--	18	18	17	16	18	24	30	38	22	18	17	0.46	0.50	0.5[illegible]	12	9	9	48.1	37.6	3[illegible]
					1	25	--	--	20	--	--	18	16	16	18	20	24	32	42	21	17	18									
					20	8	--	--	10	--	--	11	12	16	22	27	30	52	66	10	13	22									
47		12	Yes	[illegible]	0	[illegible]	--	--	16	--	--	16	16	16	16	16	24	40	34	19	16	16	Use test 11 data			11	8	9			
					1																										
					20	14	--	--	8	--	--	[illegible]	10	13	16	20	28	48	48	10	10	16									
48		15	Yes	[illegible]	[illegible]	40	--	--	40	--	--	34	[illegible]	40	34	37	42	82*	100*	31	2[illegible]	34	0.[illegible]	0.[illegible]	0.52	24	15	18	55.5	49.2	4[illegible]
					1	[illegible]	--	--	[illegible]	--	--	24	24	40	33	[illegible]	43	94*	100*	30	2[illegible]	33									
					[illegible]	[illegible]	--	--	16	--	--	30	18	22	34	[illegible]	100*	100*	100*	16	20	34*									
49	Chotard Lake	[illegible]	Yes	1	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	11	14	13	[illegible]	[illegible]	32	--	--	[illegible]	14	24	0.4[illegible]	0.[illegible]0	0.[illegible]4	2	[illegible]	1[illegible]	222.3	144.9	77
						[illegible]	--	--	10	--	--	14	[illegible]	[illegible]	[illegible]	23	[illegible]	--	--	10	24	27									
50		[illegible]	No	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	34	45	34	0.90	0.[illegible]	0.64	27	24	22	72.6	57.[illegible]	[illegible]
					1	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	42	41	30									
					[illegible]		--	--	[illegible]	--	--	[illegible]	44	[illegible]	[illegible]	[illegible]	[illegible]	--	--	40	40	28									
51		[illegible]	Yes	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]		11	[illegible]	[illegible]	40	80	--	--	[illegible]	15	28	0.57	0.[illegible]	0.38	[illegible]	10	11	112.7	[illegible]0.0	[illegible]
					1	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	--	--	16	23	25									
52		[illegible]	Yes	1	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	14	[illegible]	[illegible]	41	41	--	--	[illegible]	14	[illegible]	0.4[illegible]	0.60	0.64	2	[illegible]	[illegible]	222.3	144.9	77.
							--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	--	--	16	2[illegible]	28									
[illegible]	Carson Sink site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	44	4[illegible]	33	0.7[illegible]	0.71	0.[illegible]	[illegible]	[illegible]	22	14.3	25.2	47.
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	61	[illegible]	39									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	40	[illegible]	--	--	64	40	[illegible]									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	33	[illegible]									
							--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	64	3[illegible]	45									
[illegible]	Carson Sink site [illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	28	2[illegible]	0.[illegible]	0.[illegible]	[illegible]	24	1[illegible]	19	19.5	24.[illegible]	37.
					[illegible]	[illegible]	--	--		--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]									
						[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	[illegible]									
							--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	21	[illegible]									
					[illegible]		--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	31	[illegible]	[illegible]									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	[illegible]	[illegible]	41									
[illegible]	Four Mile Flat site	[illegible]	[illegible]							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	14	1[illegible]	2[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
							--	--		--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	11	[illegible]	[illegible]									
[illegible]	Four Mile Flat site	[illegible]	[illegible]							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	11	[illegible]	22	0.4[illegible]	[illegible]42	[illegible]	[illegible]	[illegible]	[illegible]	45.2	[illegible]	[illegible]
							--	--		--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	10	[illegible]	20									

(Continued)

A

Table 2 (Continued)

...g Cone ...f Layers ...in. ...12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph Vane c	φ	s	Rubber a	φ	S_r	Avg Rut Depth in.	Remarks
...itary Vehicles (Continued)																
...racked, Test Weight 22,600 lb (Continued)																
	22	17.9	26.5	41.4	82.1	85.4	67.5	51.4	2.9	28	6.7	1.3	26	4.6	-- 2.4 5.0 [illegible].2 11.6	Undercarriage began dragging on 14th pass and was dragging entire lane by 18th pass. Vehicle had difficulty backing up on 38th pass and became immobilized on 44th pass in reverse, but traveled forward out of test lane and reentered lane at opposite end in forward gear. Vehicle became immobilized on 49th pass in forward, and considered to be immobilized on 44th pass
	30	20.4	36.3	66.1	67.6	75.0	60.0	59.2	2.2	31	6.5	1.2	30	5.3	-- 1.7 4.9	Vehicle completed 50 passes with ease
	14	44.1	40.5	52.0	49.2	80.2	68.5	71.3	1.9	3	2.3	1.2	6	1.9	-- 11.0	Vehicle became immobilized on 1st pass. It appeared that had the soil been of slightly higher strength, vehicle might have been able to complete 1 pass
	17	44.0	52.2	49.4	46.8	67.9	68.2	70.5	2.5	3	2.9	1.8	5	2.5	-- 9.0	Vehicle became immobilized on 1st pass. Vehicle's maximum speed just before immobilization occurred was 2.88 mph
MEXA Vehicles																
..., 10x10 Truck, Test Weight 18,030 lb																
	4	84.8	62.8	51.4	50.1	61.5	70.5	71.0	--	--	--	--	--	--	-- --	Vehicle immediately became immobilized on 1st pass. Undercarriage was not dragging. Vehicle's yaw, pitch, and inching actions were tried, but vehicle could not extricate itself
	8	31.5	44.3	49.9	49.1	74.6	70.2	66.0	4.8	20	6.0	0.0	34	2.2	-- 3.3 -- 6.6 7.2	Undercarriage began dragging on 24th pass. Vehicle had extreme difficulty completing 29th pass and became immobilized on 30th pass. Vehicle's yaw, pitch, and inching actions were tried, but vehicle could not extricate itself
	11	44.7	44.2	46.3	44.2	76.8	74.9	76.0	4.4	31	6.4	0.1	30	2.0	-- 0.3 6.4	Vehicle's difficulty increased with each subsequent pass. Undercarriage was dragging entire test lane on 5th pass. Vehicle became immobilized on 40th pass. Vehicle's yaw, pitch, and inching actions were tried, but vehicle could not extricate itself
	5	62.9	52.8	43.8	42.3	69.4	77.2	78.5	1.6	16	2.5	0.5	10	1.0	-- 2.6	Vehicle became immobilized on 2d pass in forward gear. Undercarriage was not dragging. Vehicle's yaw, pitch, and inching actions were tried, but vehicle could not extricate itself
	9	48.1	37.6	35.6	37.2	82.1	85.8	83.6	2.7	1	2.8	0.6	8	1.0	-- 1.4 7.2	Vehicle began dragging on 5th pass and was dragging entire lane on 10th pass. Wheel slip occurred on [illegible] pass. Vehicle had difficulty on 14th pass and extreme difficulty (high slip) on 26th pass, but was able to complete 29th pass at 0.14 mph. Vehicle considered to be immobilized on 26th pass
	9					Use test 11 data									-- 1.4 --	Vehicle began dragging on 4th pass, had some difficulty completing 13th pass, and had extreme difficulty (high slip) on 16th pass. It became immobilized on 20th pass. Vehicle's yaw, pitch, and inching actions were tried, but vehicle could not extricate itself. Vehicle considered to be immobilized on 16th pass
	18	55.5	49.9	46.3	49.0	70.7	73.9	71.8	6.5	13	7.2	0.5	28	2.3	-- 0.8 12.1	Gradual rutting occurred with each pass until undercarriage was dragging entire lane on 28th pass. Vehicle had extreme difficulty (high slip) after 39th pass. A large amount of mud had accumulated on the tires by 39th pass. Test was halted after 47th pass to cool torque converter. Vehicle managed to complete 56th pass at 0.15 mph. Forward progress completely stopped on 57th pass. Yaw and pitch actions were tried, and after about 15 min vehicle was able to extricate itself from test lane. Vehicle considered to be immobilized on 47th pass
	15	222.3	144.9	77.9	67.3	32.7	53.0	58.7	--	--	--	0.6	4	0.8	-- 5.0	Vehicle repeated procedure of that of test 44, and was considered to be immobilized on 1st pass
	22	72.6	57.5	55.7	43.7	66.4	66.8	76.0	--	--	--	1.0	9	1.5	-- 1.3 2.4	Area covered with about 2 in. of soft slush atop soil of much higher strength. Vehicle easily completed 50 passes
	11	112.7	80.0	61.9	42.4	48.0	63.0	77.9	--	--	--	0.6	8	1.1	-- 5.5	Vehicle backed into soft area until it became immobilized but was able to extricate itself in forward using pitch and yaw action. Vehicle considered to be immobilized on 1st pass
	17	222.3	144.9	77.9	67.3	32.7	53.0	58.7	--	--	--	0.6	4	1.1	-- 6.0	Vehicle was backed into soft area to allow retrieval with winch (on front of vehicle). Vehicle became immobilized but was able to extricate itself in forward using pitch and yaw action of hydraulic system. This procedure was repeated three times and each time vehicle was able to extricate itself in forward. Vehicle considered to be immobilized on 1st pass
	22	18.3	23.2	47.4	58.1	92.9	70.8	47.7	2.3	27	[illegible]	1.2	24	4.2	-- 0.1 1.8 2.9 3.4	Vehicle completed 50 passes with ease
	19	19.5	34.5	37.8	48.9	92.1	79.[illegible]	[illegible]	[illegible]	28	[illegible]	0.7	28	4.2	-- 1.2 2.2 [illegible] [illegible].0 10.2	Mud began to accumulate on tires on [illegible] pass, and a large amount had accumulated by 31st pass. Undercarriage was dragging on [illegible] pass, but vehicle completed [illegible] passes
	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.3	1.2	[illegible]	2.2	-- [illegible]	Vehicle entered test lane and as tires became covered with mud, it slowed down and soon became immobilized (on first pass). Undercarriage did not drag
	14	48.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.3	0.7	[illegible]	[illegible]	-- [illegible]	Vehicle entered test lane and as tires became covered with mud, vehicle slowed down and soon became immobilized (on first pass). Undercarriage did not drag

(Continued)

B

Table 2 (Continued)

Avg Cone Index of Layers, in. 0-6	6-12	12-18	Remolding Index of Layers, in. 0-6	6-12	12-18	Rating Cone Index of Layers in. 0-6	6-12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-
MEXA Vehicles (Continued)												
2-1/2-Ton MEXA, 10x10 Truck, Test Weight 18,030 lb												
10	1[illegible]	26	0.54	0.70	0.69	5	11	17	47.1	51.0	53.4	[illegible]
11	21	27										
11	[illegible]	34	[illegible]	0.70	0.69	6	11	17	47.1	51.0	53.4	[illegible]
[illegible]	15	[illegible]										
1[illegible]	20	29	[illegible]	0.71	0.70	8	14	20	[illegible]	51.1	51.2	[illegible]
11	[illegible]	31										
2-1/2-Ton MEXA, 8x8 Truck, Test Weight 1[illegible]												
67	47	[illegible]	0.44	0.44	[illegible]	42	[illegible]	22	[illegible]	37.0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]										
28	25	20										
11	17	20										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.52	28	20	20	[illegible]	39.8	34.8	[illegible]
[illegible]	44	[illegible]										
19	17	17										
11	[illegible]	[illegible]										
[illegible]	[illegible]	31	[illegible]	[illegible]	0.40	20	[illegible]	12	[illegible]	41.2	35.2	[illegible]
[illegible]	27	23										
[illegible]	[illegible]	[illegible]										
14	[illegible]	[illegible]										
40	[illegible]	[illegible]	[illegible]	[illegible]	0.44	19	12	12	[illegible]	[illegible]	[illegible]	37
[illegible]	[illegible]	[illegible]										
[illegible]	[illegible]	[illegible]										
[illegible]	[illegible]	[illegible]	[illegible]	0.44	[illegible]	[illegible]	[illegible]	13	[illegible]	48.8	[illegible]	[illegible]
[illegible]	[illegible]	31										
[illegible]	14	[illegible]										
[illegible]	12	20										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.61	[illegible]	[illegible]	[illegible]	[illegible]	54.4	41.4	40
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.40	[illegible]	[illegible]	21	[illegible]	[illegible]	[illegible]	34
41	[illegible]	[illegible]										
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.47	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37.4	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	[illegible]	[illegible]	[illegible]	[illegible]
11	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	[illegible]	31	[illegible]	[illegible]	[illegible]	[illegible]

A

Table 2 (Continued)

Rating Cone Index of Layers, in. 0-6	6-12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph* Vane c	f°	S_v	Rubber a	f°	S_r	Avg Rut Depth in.	Remarks
MEXA Vehicles (Continued)																	
MEXA, 10x10 Truck, Test Weight 18,030 lb (Continued)																	
5	11	17	47.1	51.0	53.4	51.8	70.5	66.3	65.9	1.5	16	5.4	1.0	8	1.9	-- 6.6	Vehicle became immobilized on 1st pass. All tires were slipping at immobilization and completely covered with mud. Undercarriage did not drag
6	11	17	47.1	51.0	53.4	51.8	70.5	66.3	65.9	1.5	16	5.4	1.0	8	1.9	-- 7.1	Vehicle became immobilized on 1st pass. All tires were slipping at immobilization and were completely covered with mud. Undercarriage did not drag
8	14	29	50.5	51.1	51.2	50.2	68.9	69.8	66.4	2.9	1	3.0	2.2	4	2.8	-- 6.6	Vehicle became immobilized on 3d pass when all tires became covered with mud and began slipping
[illegible]/2-Ton MEXA, 8x8 Truck, Test Weight 19,013 lb																	
43	29	22	44.6	37.0	33.9	34.9	81.6	85.8	85.0	5.0	30	8.[illegible]	0.6	34	4.[illegible]	-- 0.4 3.4 9.[illegible]	Undercarriage began dragging on 8th pass and was dragged entire test lane on 16th pass. Vehicle had difficulty on 31st pass, and extreme difficulty (high slip) after 40th pass, but was able to complete 50 passes. Maximum speed on 50th pass was 0.95 mph
28	20	20	37.2	35.8	34.8	34.2	83.5	84.1	74.4	[illegible]	19	7.3	1.0	2[illegible]	3.7	-- 0.[illegible] 9.4 11.0	Vehicle began dragging on 6th pass and was dragging entire lane on 16th pass. It had extreme difficulty (high slip) on 34th pass. All eight wheels were slipping on 36th pass, and vehicle was making very little forward progress. It was considered to be immobilized on 36th pass
20	13	12	53.9	41.2	39.2	36.0	76.6	83.0	82.0	3.5	12	4.7	0.8	9	1.8	-- 1.0 [illegible] 6.5	Vehicle was dragging on 4th pass with some wheel slip and was dragging entire test lane on 6th pass. Vehicle had extreme difficulty on 8th pass and was able to complete 10th pass at only 0.41 mph. On 11th pass all wheels were spinning and vehicle was making very little forward progress and was considered to be immobilized. Vehicle's inching action was used, and after 15 min of effort vehicle was able to extricate itself
19	12	12	51.2	41.0	39.0	37.5	78.7	80.0	83.[illegible]	3.0	11	4.2	0.[illegible]	[illegible]	1.1	-- 1.0 3.8	A small amount of surface water was on lane after 1st pass. On 3d pass vehicle started slipping all eight wheels and became immobilized. Undercarriage was not dragging. Vehicle was able to back out of test lane
15	15	13	53.9	48.8	39.3	37.0	70.8	80.4	82.7	[illegible]	18	7.5	1.4	18	3.3	-- 1.1 8.2 10.7	Vehicle began to drag on 6th pass and was dragging entire test lane on [illegible] pass. Vehicle's difficulty increased with each pass. Speed on [illegible]0th pass was 0.41 mph. Vehicle considered to be immobilized on [illegible]st pass as all wheels were slipping and very little forward progress was being made
[illegible]	13	12	[illegible]	54.4	41.4	40.2	67.3	79.4	80.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- 0.7 12.0	Vehicle's undercarriage was dragging on 7th pass and was dragging entire lane on 1[illegible]th pass. Vehicle had extreme difficulty (high slip) on [illegible] pass, and speed on [illegible] pass was only 0.[illegible] mph. Vehicle considered to be immobilized on [illegible] pass. Yaw, pitch, and inching actions were tried, but the vehicle could not extricate itself
43	41	21	43.0	34.4	[illegible]	34.9	81.[illegible]	[illegible]	84.0	7.1	34	11.0	0.[illegible]	[illegible]	4.7	-- 0.[illegible] 4.8	Vehicle began to drag on [illegible] pass. Made [illegible]0 passes with relative ease
34	15	11	45.6	[illegible]	37.4	[illegible]	82.[illegible]	82.8	84.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- 0.[illegible] 9.[illegible]	Vehicle was dragging on 7th pass and was dragging entire test lane on [illegible] pass. Vehicle's difficulty gradually increased with each subsequent pass. Speed on [illegible] pass was 0.[illegible] mph. Wheels were slipping on [illegible] pass with very little forward progress. It was considered to be immobilized on [illegible] pass
21	18	17	19.5	34.[illegible]	37.8	[illegible]	92.1	79.[illegible]	62.7	[illegible].2	28	7.[illegible]	[illegible]	[illegible]	[illegible]	-- 1.[illegible] [illegible]	Mud began to accumulate on tires on [illegible] pass. Vehicle experienced extreme difficulty, and undercarriage was dragging entire test lane by 22d pass. Vehicle became immobilized on [illegible] pass. Vehicle started forward and the [illegible] differential failed
[illegible]	8	1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible]	Vehicle entered test lane [illegible] speed test. [illegible] became immobilized with all tires slipping. Undercarriage was not dragging
10	10	14	44.1	40.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible]	Vehicle became immobilized on 1st pass when all tires became covered with mud and began slipping. Undercarriage was not dragging
20	11	21	41.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible]	[illegible]
[illegible]																	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-- [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	--	--	--	--	-- [illegible]	[illegible]

[illegible] (Continued)

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B

Table 2 (Concluded

Item No.	Site Location	Test No.	Remolding Yes or No	Pass No.	Data Pass No.	Cone Index at Depths, in. 0	1	2	3	4	5	6	9	12	15	18	24	30	36	Avg Cone Index of Layers, in. 0-6	6-12	12-18	Remolding Index of Layers, in. 0-6	6-12	12-18	Rating Cone Index of Layers in. 0-6	6-12	12-18	Moisture (% Dry Wt) of 0-1	0-6	[illegible]
																													MEXA Vehicles (Continue		
																													MEXA Track, Test Weight 19,680 lb		
77	WES	[illegible]	Yes	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	11	10	10	12	15	24	--	--	14	10	12	0.49	0.55	0.58	7	6	7	68.6	58.4	
					1	11	--	--	[illegible]	--	--	[illegible]	8	10	12	18	[illegible]	--	--	8	8	13									
78	↓	10	Yes	[illegible]	0	[illegible]	--	--	[illegible]	--	--	14	14	13	12	14	19	--	--	19	14	13	0.48	0.60	0.64	9	8	8	50.7	44.7	
					1	[illegible]	--	--	10	--	--	[illegible]	[illegible]	10	13	16	24	--	--	11	9	13									
					[illegible]	[illegible]	--	--	[illegible]	--	--	10	11	[illegible]	24	30	[illegible]	--	--	9	12	23									
79	↓	[illegible]	Yes	[illegible]	0	[illegible]	--	--	[illegible]	--	--	[illegible]	44	[illegible]	42	41	44	--	--	46	45	43	0.63	0.52	0.36	29	23	15	46.4	40.1	
					1	[illegible]	--	--	[illegible]	--	--	31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	--	31	30	32									
					[illegible]	[illegible]	--	--	[illegible]	--	--	21	12	13	[illegible]	22	31	--	--	9	14	20									
80	↓	[illegible]	Yes	22	0	[illegible]	--	--	[illegible]	--	--	[illegible]	38	31	40	[illegible]	31	--	--	61	41	29	0.40	0.44	0.42	24	18	12	35.8	33.9	
					1	[illegible]	--	--	10	--	--	[illegible]	34	29	30	32	29	--	--	47	33	30									
					21	10	--	--	[illegible]	--	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	31	--	--	13	18	28									
81	↓	[illegible]	Yes	[illegible]	[illegible]	[illegible]	--	--	[illegible]	--	--	74	71	48	39	41	33	--	--	72	64	42	0.34	0.42	0.47	24	27	20	38.9	33.8	[illegible]
					1	[illegible]	--	--	[illegible]	--	--	40	[illegible]	12	42	[illegible]	[illegible]	--	--	58	67	50									
					[illegible]	[illegible]	--	--	12	--	--	12	[illegible]	20	23	27	32	--	--	11	16	24									
82	Carson Sink site 2	44	No	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40	[illegible]	42	44	34	[illegible]	[illegible]	50	--	--	46	43	32	0.77	0.78	0.59	35	34	19	19.0	28.3	4
					1	[illegible]	--	--	52	--	--	48	50	[illegible]	38	43	[illegible]	--	--	49	48	39									
					[illegible]	[illegible]	--	--	40	--	--	42	27	30	[illegible]	[illegible]	[illegible]	--	--	56	36	34									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	28	32	48	[illegible]	[illegible]	--	--	47	31	39									
					[illegible]	[illegible]	--	--	[illegible]	--	--	[illegible]	[illegible]	32	31	42	[illegible]	--	--	39	28	35									
83	Carson Sink site 3	[illegible]	[illegible]	--	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30	[illegible]	27	40	[illegible]	[illegible]	--	--	31	27	30	0.74	0.72	0.65	23	19	20	21.4	28.1	3
					[illegible]	[illegible]	--	--	[illegible]	--	--	31	27	31	29	[illegible]	[illegible]	--	--	40	30	32									
					[illegible]	[illegible]	--	--	24	--	--	[illegible]	[illegible]	27	27	31	48	--	--	24	24	28									
					[illegible]	[illegible]	--	--	[illegible]	--	--	23	[illegible]	28	[illegible]	[illegible]	42	--	--	24	25	29									
					[illegible]	[illegible]	--	--	20	--	--	20	22	27	30	[illegible]	[illegible]	--	--	20	23	31									
					[illegible]	17	--	--	18	--	--	19	22	24	[illegible]	40	41	--	--	18	22	26									
84	Four Mile Flat site 7	13[illegible]	Yes	[illegible]	[illegible]	[illegible]	10	14	11	13	[illegible]	14	17	19	22	28	40	--	--	13	17	23	0.46	0.58	0.63	6	10	14	58.8	48.4	5[illegible]
85	Four Mile Flat site [illegible]	147	Yes	2	[illegible]	[illegible]	[illegible]	7	[illegible]	[illegible]	[illegible]	10	13	17	20	24	24	--	--	8	13	20	0.38	0.57	0.62	3	7	12	54.2	50.3	60
					[illegible]	[illegible]	--	--	[illegible]	--	--	13	17	18	20	24	--	--	--	9	16	21									
86	Four Mile Flat site [illegible]	138	No	--	0	[illegible]	[illegible]	[illegible]	28	40	42	31	27	27	28	40	[illegible]	--	--	40	28	28	0.61	0.74	0.71	18	21	20	49.2	43.8	42
					50	[illegible]	--	--	14	--	--	[illegible]	17	31	--	--	--	--	--	14	21	--									

A

Table 2 (Concluded)

g Cone f Layers n. 12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph Vane c	ϕ°	S_v	Rubber a	ϕ°	S_r	Avg Rut Depth in.	Remarks
MEXA Vehicles (Continued)																
ack, Test Weight 19,680 lb (Continued)																
6	7	68.6	58.4	44.6	42.1	65.0	76.4	78.1	1.0	16	2.2	1.8	8	1.8	-- 7.5	Vehicle became immobilized on 2d pass; undercarriage was dragging. Vehicle's yaw, pitch, and inching actions were tried, but the vehicle could not extricate itself
8	8	50.7	44.7	40.9	38.4	76.1	79.0	83.4	4.8	1	4.8	1.7	10	2.3	-- 4.8 11.9	Vehicle began dragging on 2d pass and was dragging entire lane on 3d pass. It became immobilized on 5th pass
8	15	46.4	40.1	33.2	33.1	80.2	87.2	84.8	3.7	1	3.8	1.2	8	1.5	-- 1.7 12.6	Vehicle began dragging on 7th pass and was dragging entire lane by 10th pass. It had difficulty completing 20th pass and became immobilized on [illegible]th pass. Vehicle's yaw, pitch, and inching actions were tried, but the vehicle could not extricate itself
8	12	35.8	33.9	34.7	34.6	86.0	85.9	84.1	8.0	2	8.1	0.0	42	2.4	-- 1.2 9.2	Vehicle began dragging on 8th pass and had extreme difficulty (high slip) from 16th pass to 22d pass in which immobilization occurred. Vehicle's inching action was tried, but the vehicle could not extricate itself
7	20	38.9	33.8	35.5	35.0	84.4	84.2	83.2	5.4	0	5.4	0.3	39	2.4	-- 1.4 10.3	Vehicle began dragging on 12th pass, had some difficulty on 16th pass, had extreme difficulty on 33d pass, and became immobilized on 44th pass. Inching action was tried, but the vehicle could not extricate itself
	19	19.0	28.3	46.8	76.2	78.3	67.2	52.4	2.7	28	4.1	1.0	28	2.4	-- 1.7 2.9 5.6 7.0	Undercarriage was dragging on mud buildup between ruts on 35th pass. Vehicle completed 50 passes without difficulty
	20	21.4	28.1	35.8	60.9	86.4	79.9	62.0	3.8	24	5.0	0.8	28	2.2	-- 1.5 4.8 7.7 10.4 11.8	Undercarriage was dragging on mud buildup between ruts on 10th pass. Vehicle completed 54 passes with some difficulty (track slip)
	14	58.8	48.4	55.3	51.8	73.2	67.4	68.2	1.6	6	1.8	1.2	9	1.5	-- 19.0	Undercarriage began dragging heavily on [illegible]th pass. Vehicle became immobilized on [illegible]th pass. Vehicle's yaw, pitch, and inching actions were tried, but the vehicle could not extricate itself
	12	54.2	50.3	60.7	57.1	71.1	63.9	66.2	1.0	8	1.4	1.0	7	1.3	-- 10.8	Vehicle became immobilized on 2d pass going forward. Vehicle's yaw, pitch, and inching actions were tried, but the vehicle could not extricate itself
	20	49.2	43.8	42.7	44.2	74.0	73.2	73.0	2.2	5	2.4	1.6	7	1.0	-- 12.5	Vehicle was dragging entire test lane by 7th pass. Difficulty in travel increased with each pass after 13th pass. Vehicle completed [illegible]0 passes with difficulty

Table 3

Summary of Soil Data for Drawbar Pull-Slip, Motion Resistance, and Drawbar Pull-Speed Tests

Item No.	Site Location and No.	Test No.	Cone Index at Depths, in. 0	1	2	3	4	5	6	9	12	15	18	24	Avg Cone Index of Layers, in. 0-6	6-12	12-18	Remolding Index of Layers, in. 0-6	6-12	12-18	Rating Cone Index of Layers in. 0-6	6-12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph* Vane c	Vane φ	Vane S_v	Rubber a	Rubber φ	Rubber S_r	Avg Rut Depth** in.
	Military Vehicles																																					
	2-1/2-Ton XM410E1, 8x8 Truck, Test Weight 16,504 lb																																					
	Carson Sink:																																					
87	Site 4	66	35	47	70	53	82	71	65	59	49	58	61	66	67	61	59	0.74	0.66	0.54	50	40	32	21.2	38.4	64.2	74.9	75.5	60.5	55.0	3.5	29	12.8	1.2	33	12.2	2.5
88	Site 4	66B	35	47	70	53	82	71	65	59	49	58	61	66	67	61	59	0.74	0.66	0.54	50	40	32	21.2	38.4	64.2	74.9	75.5	60.5	55.0	3.5	29	12.8	1.2	33	12.2	
89	Site 2	59	25	34	46	56	61	59	55	45	36	29	35	41	48	45	33	0.77	0.78	0.59	37	35	19	19.0	28.3	46.8	76.2	78.3	67.2	52.4	2.7	28	11.8	1.0	28	10.0	4.3
90	Site 2	59B	25	34	46	56	61	59	55	45	36	29	35	41	48	45	33	0.77	0.78	0.59	37	35	19	19.0	28.3	46.8	76.2	78.3	67.2	52.4	2.7	28	11.8	1.0	28	10.0	
91	Site 3	62	21	30	38	39	39	35	35	25	26	31	27	35	34	29	28	0.71	0.71	0.66	24	21	18	20.2	26.2	36.8	59.9	89.9	79.4	62.0	3.5	26	11.7	0.8	28	9.8	6.1
92	Site 3	62B	21	30	38	39	39	35	35	25	26	31	27	35	34	29	28	0.71	0.71	0.66	24	21	1	20.2	26.2	36.8	59.9	89.9	79.4	62.0	3.5	26	11.7	0.8	28	9.8	
	2-1/2-Ton M35A2 (mod), 6x6 Truck, Test Weight 18,225 lb																																					
94	Site 4	44	39	47	71	84	83	72	66	59	59	57	61	66	67	61	59	0.74	0.66	0.54	50	40	32	21.2	38.4	64.2	74.9	75.5	60.5	55.0	3.5	29	18.7	1.2	33	19.0	3.6
95	Site 4	44B	39	47	71	84	83	72	66	59	59	57	61	66	67	61	59	0.74	0.66	0.54	50	40	32	21.2	38.4	64.2	74.9	75.5	60.5	55.0	3.5	29	18.7	1.2	33	19.0	
96	Site 2	49	25	34	47	56	61	59	54	44	37	28	36	42	48	45	34	0.77	0.78	0.59	37	35	19	19.0	28.3	46.8	76.2	78.3	67.2	52.4	2.7	28	17.5	1.0	28	15.5	7.7
97	Site 2	49B	25	34	47	56	61	59	54	44	37	28	36	42	48	45	34	0.77	0.78	0.59	37	35	19	19.0	28.3	46.8	76.2	78.3	67.2	52.4	2.7	28	17.5	1.0	28	15.5	
98	Site 5	88	70	111	150	138	111	98	103	109	81	71	71	89	112	98	74	1.54	0.92	0.68	172	90	50	10.4	25.4	92.0	101.6	82.8	47.8	43.8	3.6	45	31.4	1.2	43	26.8	2.6
	M113 APC, Full Tracked, Test Weight 22,600 lb																																					
99	Site 4	71	45	61	72	82	91	74	66	58	60	56	54	57	71	61	57	0.74	0.66	0.54	53	40	31	21.2	38.4	64.2	74.9	75.5	60.5	55.0	3.5	29	7.4	1.2	33	5.7	3.0
100	Site 4	71B	45	61	72	82	91	74	66	58	60	56	54	57	71	61	57	0.74	0.66	0.54	53	40	31	21.2	38.4	64.2	74.9	75.5	60.5	55.0	3.5	29	7.4	1.2	33	5.7	
101	Site 2	75	25	34	47	57	61	59	55	45	36	28	34	42	48	45	33	0.77	0.78	0.59	37	35	19	19.0	28.3	46.8	76.2	78.3	67.2	52.4	2.7	28	6.5	1.0	28	4.7	6.8
102	Site 2	75B	25	34	47	57	61	59	55	45	36	28	34	42	48	45	33	0.77	0.78	0.59	37	35	19	19.0	28.3	46.8	76.2	78.3	67.2	52.4	2.7	28	6.5	1.0	28	4.7	
103	Site 3	79	19	28	40	42	40	36	34	28	26	29	25	34	34	30	27	0.71	0.71	0.66	24	21	18	20.2	26.2	36.8	59.9	89.9	79.4	62.0	3.5	26	7.0	0.8	28	4.6	7.2
104	Site 3	79B	19	28	40	42	40	36	34	28	26	29	25	34	34	30	27	0.71	0.71	0.66	24	21	18	20.2	26.2	36.8	59.9	89.9	79.4	62.0	3.5	26	7.0	0.8	28	4.6	
	Four Mile Flat:																																					
105	Site 6	142	18	22	30	34	32	37	43	30	25	33	51	65	29	33	43	0.61	0.63	0.60	19	21	26	36.0	58.4	38.7	36.0	82.9	75.1	79.2	2.7	4	3.2	1.0	25	4.3	7.0
106	Site 6	143	17	24	25	26	31	33	31	24	28	29	33	41	27	29	30	0.68	0.62	0.63	18	19	19	50.2	48.9	49.5	52.0	68.3	70.3	66.6	2.5	1	2.6	1.6	5	2.2	4.6
	MEXA Vehicles																																					
	2-1/2-Ton MEXA, 10x10 Truck, Test Weight 18,030 lb																																					
	Carson Sink:																																					
107	Site 4	24	43	45	66	73	78	69	64	58	54	55	55	61	60	59	55	0.86	0.65	0.62	52	38	34	19.9	38.6	58.4	72.5	63.4	64.3	55.9	3.2	28	6.9	1.0	30	4.9	1.1
108	Site 2	27	29	34	47	54	55	51	48	40	32	30	35	47	46	40	32	0.76	0.74	0.65	35	30	17	15.9	20.5	48.2	87.8	89.8	68.9	47.6	3.0	24	6.0	1.4	23	4.2	1.3
109	Site 2	27B	29	34	47	54	55	51	48	40	32	30	35	47	46	40	32	0.76	0.74	0.65	35	30	17	15.9	20.5	48.2	87.8	89.8	68.9	47.6	3.0	24	6.0	1.4	23	4.2	
110	Site 4	30B	43	45	66	73	78	69	64	58	54	55	55	61	60	59	55	0.86	0.65	0.62	52	38	34	19.9	38.6	58.4	72.5	63.4	64.3	55.9	3.2	28	6.9	1.0	30	4.9	1.1
111	Site 3	32	22	42	36	37	36	35	32	27	25	30	34	36	33	29	31	0.69	0.69	0.65	23	20	20	19.5	24.5	37.8	68.9	92.1	79.6	62.7	3.2	23	6.3	0.7	28	4.3	1.2

(Continued)

Note: In tests 159A and 163A the 0- to 2.5-in. layer of soil was removed from ground surface by hand before data were taken and tests were conducted. Tests 159B and 163B were conducted on the natural surface adjacent to tests 159A and 163A, respectively.

* c indicates cohesion, psi.
φ indicates angle of friction, deg.
S_v and S_r indicate values, in psi, for the vane head and rubber head, respectively, read from shear stress/normal stress curves at normal ground contact pressure.
a indicates soil to rubber adhesion, psi.

** Average rut depth after drawbar pull tests.

(1 of 2 sheets)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Shear Strength						[illegible]
															C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] (Continued)																					
[illegible] Test Weight [illegible] lb (Continued)																					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	70.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.1	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	[illegible]	[illegible]	[illegible]	[illegible]	10.0	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	46.7	[illegible]	64.8	72.3	71.0	64.5	[illegible]	[illegible]	3.1	2.0	[illegible]	2.4	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	72.3	71.0	[illegible]	[illegible]	11	[illegible]	2.8	14	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22	[illegible]	53.3	[illegible]	51.5	67.4	[illegible]	67.0	3.5	[illegible]	4.1	[illegible]	12	3.1	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	14	[illegible]	[illegible]	53.3	50.4	51.5	67.4	[illegible]	67.0	[illegible]	4	[illegible]	2.4	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	53.0	[illegible]	51.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	2.7	1.5	[illegible]	2.3	[illegible]
[illegible] M29A, [illegible] Test Weight [illegible] lb																					
[illegible]	[illegible]	0.74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	31.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55.0	[illegible]	29	[illegible]	1.2	[illegible]	[illegible]	3.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	[illegible]	20.2	[illegible]	[illegible]	[illegible]	[illegible]	79.4	[illegible]	3.5	[illegible]	7.6	[illegible]	28	5.4	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	[illegible]	20.2	[illegible]	[illegible]	[illegible]	[illegible]	79.4	62.0	[illegible]	[illegible]	[illegible]	[illegible]	29	5.4	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50.3	3.1	[illegible]	7.2	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50.3	[illegible]	[illegible]	7.2	0.9	30	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	67.6	[illegible]	[illegible]	[illegible]	31	5.5	0.9	[illegible]	[illegible]	--
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13	[illegible]	17	[illegible]	[illegible]	[illegible]	[illegible]	67.1	69.4	[illegible]	3.3	[illegible]	[illegible]	1.4	12	3.2	3.6
[illegible]	[illegible]	[illegible]	[illegible]	2.72	13	[illegible]	17	[illegible]	53.0	49.9	[illegible]	67.1	68.4	67.9	3.3	9	4.6	1.4	12	3.2	3.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22	21	[illegible]	[illegible]	[illegible]	[illegible]	72.0	[illegible]	69.1	[illegible]	4	2.4	1.7	[illegible]	2.4	1.0
[illegible]-Ton MEXA Trac[illegible], Test Weight 1[illegible],6[illegible]0 lb																					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	72.5	63.4	64.3	55.9	3.2	[illegible]	4.6	1.0	30	2.5	--
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	38	[illegible]	19.9	[illegible]	58.4	72.5	63.4	64.3	55.9	3.2	28	4.6	1.0	30	2.5	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	32	28	21	18.3	23.2	47.4	58.1	92.9	70.8	47.7	2.8	27	4.1	1.2	24	2.3	2.6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	[illegible]	23.2	47.4	[illegible]	92.9	[illegible]	47.7	2.8	27	4.1	1.2	24	2.3	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23	20	19	20.2	26.2	36.8	59.9	[illegible]	79.4	[illegible]	3.5	26	4.7	0.8	28	2.2	2.9
[illegible]	[illegible]	0.71	0.71	[illegible]	23	20	19	[illegible]	[illegible]	36.8	59.9	89.9	79.4	[illegible]	3.5	26	4.7	0.8	28	2.2	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	159	[illegible]	[illegible]	10.4	25.4	92.0	101.6	[illegible]	[illegible]	43.8	3.6	45	5.4	1.2	43	3.7	1.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	159	68	46	[illegible]	25.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	45	5.4	1.2	43	3.7	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	42	31	[illegible]	[illegible]	66.9	[illegible]	67.6	[illegible]	50.3	3.2	31	4.7	0.9	[illegible]	2.7	1.7

(Continued)

(2 of 3 sheets)

Table 3 (Concluded)

[illegible]	[illegible]	[illegible]	Cone Index of Layers, in.												Avg Cone Index of Layers, in. 0-6	6-12	12-18	Remolding Index of Layers, in. 0-6	6-12	12-18	Rating Cone Index of Layers, in. 0-6	6-12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph Vane c	Vane ϕ^o	Vane S_v	Rubber a	Rubber ϕ^o	Rubber S_r	Avg Rut Depth in.
															MEXA Vehicles (Continued)																						
															-1/ -Ton MEXA Track, Test Weight 1[illegible],680 lb (Continued)																						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	54	0.71	0.70	0.57	49	42	31	[illegible]	42.6	56.3	[illegible]	67.6	64.8	[illegible]	3.2	31	4.7	0.9	36	2.7	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20	19	[illegible]	[illegible]	0.77	0.79	16	15	19	47.1	52.6	50.1	49.5	68.2	67.8	69.3	2.3	10	2.8	0.8	11	1.4	1.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25	19	24	0.50	0.73	0.72	9	14	17	35.5	48.7	44.8	51.5	65.5	72.1	66.2	2.7	7	3.0	2.0	6	2.2	5.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22	[illegible]	20	17	22	0.62	[illegible]	0.70	4	12	15	56.8	62.7	50.7	57.5	61.6	[illegible]	63.7	1.7	11	2.2	1.2	12	1.7	9.7

(3 of 3 sheets)

Table [illegible]

Summary of Vehicle Performance Data, Drawbar Pull-Slip Test Results

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		XM-1 [illegible]				
		[illegible] Site [illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	*	*	[illegible]
		Low, 2d	10.2[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible].22	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible],2[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
		Carson Sink Site [illegible]				
[illegible]	[illegible]	Low, 1st	[illegible]	[illegible]	2,337	[illegible]
			[illegible]	[illegible]	[illegible]	2.4
			[illegible]	2,4[illegible]	4,270	[illegible]
			[illegible]	[illegible],427	[illegible]	[illegible]
			3.33	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	7,2[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	13.3
			[illegible]	[illegible]	[illegible]	17.7
			[illegible].41	7,7[illegible]	[illegible]	31.3
			[illegible]	7,625	[illegible]	39.5
			[illegible]	7,615	[illegible]	69.3
			[illegible]	[illegible]	[illegible],027	[illegible]
			[illegible]	4,274	[illegible]	6.4
			2.[illegible]	[illegible]	7,47[illegible]	11.7
			[illegible]	7,2[illegible]	[illegible],614	14.7
			1.23	[illegible]	[illegible]	22.5
			0.66	[illegible]	10,053	46.2
			0.35	[illegible]	[illegible]	77.0
			0.00	[illegible]	10,3[illegible]	100.0

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		XM-1 [illegible] (Continued)				
		[illegible] Site (Continued)				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
		Low, 2d	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
		Carson Sink Site [illegible]				
[illegible]	[illegible]	Low, 1st	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	2,[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	13.[illegible]
			[illegible]	[illegible]	[illegible]	20.[illegible]
			2.[illegible]	[illegible]	[illegible]	35.[illegible]
			[illegible]	[illegible]	[illegible]	44.2
			[illegible]	[illegible]	[illegible]	5[illegible]
			1.16	2,[illegible]	[illegible]	72.[illegible]
			[illegible]	2,3[illegible]	[illegible]	73.[illegible]
			[illegible]	2,[illegible]	[illegible]	82.3
			[illegible]	[illegible]	[illegible],442	21.4
			[illegible]	[illegible]	[illegible]	25.4
			[illegible]	[illegible]	7,377	39.4
			1.63	[illegible]	7,569	45.1
			[illegible]	[illegible]	7,533	55.1
			[illegible]	4,23[illegible]	7,[illegible]	65.8
			[illegible]	4,13[illegible]	[illegible]	83.0
[illegible]	622	Low, 1st	[illegible]	64	1,769	1.6
			[illegible]	526	2,154	4.4
			7.35	1,624	3,391	7.2
			[illegible]	2,23[illegible]	3,959	10.2
			4.31	1,272	4,930	16.4
			3.12	1,673	5,269	32.6
			2.48	1,750	5,434	43.7
			[illegible]	3,776	5,434	57.3
			[illegible]	4,007	5,556	61.2
			[illegible]	4,161	5,994	75.2
			5.24	2,055	4,949	11.2
			2.34	3,553	5,480	34.1
			2.31	3,648	5,773	45.0
			1.65	3,750	5,902	59.4
			3.01	2,995	5,618	28.5
			3.79	2,918	4,921	24.0
			3.01	2,892	5,343	36.4
			2.49	2,566	5,892	40.8
			1.69	3,305	6.415	46.9

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		XM-1[illegible]E1 (Continued)				
		Carson Sink Site [illegible] (Continued)				
[illegible] (Continued)	[illegible]	Low, 3d	[illegible]	[illegible]	2,[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
		Vicksburg Pavement Site				
[illegible]	[illegible]	Low, 1st	[illegible]	[illegible]	[illegible]	[illegible]
			4.25	[illegible]	[illegible]	1.2
			[illegible]	[illegible]	[illegible]	1.2
			[illegible]	[illegible]	[illegible],424	2.[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			4.25	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	--	[illegible]
			[illegible].22	[illegible]	--	[illegible]
			2.[illegible]	[illegible]	12,[illegible]	[illegible].2
			[illegible]	27	--	[illegible]
			[illegible]	3,4[illegible]	--	[illegible]
			7.10	[illegible]	--	[illegible]
			[illegible]	[illegible]	--	[illegible].2
			[illegible]	[illegible]	--	[illegible]
			[illegible]	7,30[illegible]	--	[illegible].2
			[illegible].20	[illegible]	--	[illegible]
			2.10	[illegible]	--	[illegible]
			2.30	[illegible]	--	[illegible].2
			2.3[illegible]	[illegible]	--	[illegible].5
			[illegible].00	*	--	--
		Low, 2d	[illegible]	211	1,7[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	0.7
			14.[illegible]	[illegible]	3,702	0.7
			12.24	[illegible]	[illegible]	[illegible]
			7.43	[illegible],422	5,443	[illegible]
			[illegible].45	5,15[illegible]	6,314	[illegible]
			3.20	5,[illegible]	7,350	3.1
			3.70	7.6[illegible]	[illegible]	3.7
			[illegible].12	[illegible],343	10,42[illegible]	2.1
			3.10	[illegible],607	10,[illegible]32	[illegible]
		Low, 3d	21.63	105	--	0.0
			21.07	1,658	2.502	1.4
			16.73	2,448	2,832	0.5
			10.23	3,237	--	1.3
			6.56	3,948	4,353	1.9
			3.37	4.659	5,013	2.4
			4.77	6,501	7,350	7.0
			5.38	6,027	6,644	3.1
			5.04	6,712	7,350	3.3
			5.05	8,028	9,366	--
		High, 1st	14.10	2,062	2,786	0.3
			15.90	2,075	2,620	0.0
			20.50	793	2,175	0.0
			19.40	1,356	2,459	0.7
			9.90	3,357	2,861	0.2
			7.20	3,885	4,657	1.5
			3.80	4,255	5,362	1.9
			2.30	4,255	5,500	1.7
			1.20	4.337	5,548	1.7
			0.00	4,361	5,315	--

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		XM-1[illegible]E1 (Continued)				
		Vicksburg Pavement Site (Continued)				
[illegible] (Continued)	16[illegible]S	High, 2d	25.2	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible],[illegible]12	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible].2[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	--
		High, 3d	2[illegible]	[illegible]	1,[illegible]	[illegible]
			[illegible]	[illegible]	1,[illegible]47	[illegible]
			2[illegible]	1,227	1,[illegible]	0.[illegible]
			[illegible]	1,[illegible]	[illegible]	0.[illegible]
			7.60	[illegible]	[illegible],42[illegible]	[illegible]
			1.70	[illegible]	--	67.6
			0.00	[illegible],51[illegible]	--	--
		M35A2 (mod)				
		Carson Sink Site [illegible]				
94	46	Low, 1st	2.6[illegible]	[illegible]85	2,0[illegible]	1.8
			2.52	1,478	3.471	1.8
			2.04	2,956	[illegible]	6.0
			2.34	3,849	[illegible],750	6.3
			2.29	[illegible]	[illegible],708	[illegible]
			2.19	5,482	7,402	10.7
			2.24	5,666	7,816	[illegible]
			1.[illegible]	[illegible],253	10,405	17.8
			1.60	8,561	10,709	20.7
			1.4[illegible]	8,499	10,592	10.1
			0.99	8,007	10,358	17.2
			3.47	216	2,036	0.5
			3.28	1,971	3,635	3.5
			3.24	2,956	4,649	4.7
			3.12	4,434	6,[illegible]	8.5
			3.04	6,221	[illegible],323	11.7
			2.64	7,945	9,922	16.1
			2.47	8,130	10,132	15.4
			2.32	8,191	10,179	16.1
			1.78	9,546	11.606	24.3
			1.15	8,992	11,240	24.3
			0.00	*	*	--
95	466	Low, 1st	4.79	257	2.597	1.5
			4.73	2,186	4,610	3.4
			4.64	3,086	5,530	5.2
			4.59	3,922	6,552	3.3
			4.46	5,047	7,519	7.4
			4.02	6,108	8,923	11.0
			3.59	7,136	9,797	12.8
			2.76	8,615	11,349	16.4
			2.09	8,615	11,497	17.8
			1.87	8.936	11,599	11.6
			1.36	9,708	12,176	20.4
			0.00	*	*	--

(Continued)

Note: Performance in terms of force (at the wheel- or track-ground interface) was computed from drive-line torque divided by vehicle weight without regard to efficiency losses between torque sensor and wheel- or track-ground interface.
* The vehicle's power train could not develop enough force to produce 100% slip between the traction element and the particular ground condition.

(1 of 8 sheets)

Table 4 (Continued)

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		M35A2 (mod) (Continued)				
		Carson Sink Site [illegible]				
[illegible]	[illegible]	Low, 1st	2.0[illegible]	0	1,50[illegible]	0.6
			2.57	1,1[illegible]	2,[illegible]12	2.4
			2.5[illegible]	[illegible],[illegible]71	3,674	3.3
			2.41	3,1[illegible]	4,[illegible]37	5.5
			[illegible].[illegible]7	3,734	5,320	3.7
			2.4[illegible]	5,516	7,254	7.7
			2.[illegible]6	6,[illegible]81	[illegible],61[illegible]	11.[illegible]
			2.[illegible]	[illegible],13[illegible]	10,7[illegible]7	11.[illegible]
			1.2[illegible]	11,25[illegible]	13,174	31.5
			2.[illegible]	4,[illegible]11	6,256	[illegible].7
			1.5[illegible]	5,36[illegible]	7,[illegible]0	5.6
			2.3[illegible]	[illegible],53[illegible]	[illegible],06[illegible]	12.2
			2.2[illegible]	[illegible]	12,074	25.2
			1.1[illegible]	11,[illegible]3	13,057	21.7
			0.00	*	*	--
		Nevada Pavement Site				
[illegible]	[illegible]	Low, 1st	[illegible]	[illegible]	[illegible]	1.0
			[illegible]	1,[illegible]73	2,[illegible]	[illegible]
			[illegible].72	[illegible],2[illegible]	[illegible],22[illegible]	3.[illegible]
			[illegible]	[illegible],470	[illegible],[illegible]6	4.0
			[illegible]	[illegible]	[illegible],70[illegible]	4.7
			[illegible].72	5,756	[illegible],934	[illegible].3
			[illegible]	[illegible],0[illegible]0	[illegible]	6.2
			[illegible]	[illegible]	[illegible],627	6.2
			[illegible].54	[illegible],[illegible]00	[illegible]	7.[illegible]
			[illegible].7[illegible]	10,507	11,3[illegible]	6.[illegible]
			[illegible]	[illegible]	[illegible]	[illegible].7
			[illegible]	[illegible]	2,2[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	2.1
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	1[illegible].4
			[illegible]	*	*	--
		[illegible]	[illegible]	[illegible]	[illegible]	--
			[illegible]	2[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]22	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
		[illegible]	[illegible]	[illegible]	7[illegible]	--
			[illegible]	[illegible]	2,[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	2,722	--
			[illegible]	[illegible]	2,[illegible]12	--
		M35A2 (mod) (Continued)				
		Nevada Pavement Site (Continued)				
1[illegible] (Continued)	115S	Low, 4th	23.49	1,227	1,568	0.07
			21.26	1,9[illegible]7	1.747	0.11
			18.02	2.151	1,903	0.12
			13.24	2,338	2,137	0.13
			[illegible].70	2,385	2,137	0.13
			2.73	3,445	1,615	0.19
		Low, 5th	26.16	1,122	1,817	0.06
			17.[illegible]	1,[illegible]2	1,888	0.11
			9.63	2,104	1,888	0.12
			3.11	1.707	1,271	0.09
		High, 1st	5.62	5,091	6,297	--
			7.94	4,322	5,482	--
			9.62	2,650	4,620	--
		High, 5th	27.77	819	1,079	--
			41.50	0	0	--
		M113				
		Carson Sink Site 4				
[illegible]	71	1st and 1st converter	4.50	2,847	5,003	2.2
			3.32	5,600	8,395	3.1
			3.1[illegible]	6,907	9,219	2.6
			1.[illegible]	9,334	12,017	5.0
			1.9[illegible]	9,3[illegible]1	12,055	5.0
			1.22	11,364	14,178	[illegible].7
			0.[illegible]	13,301	15,50[illegible]	11.6
			[illegible].50	14,141	16,645	17.3
			[illegible].35	14,701	17,276	17.[illegible]
			0.21	15,16[illegible]	17,[illegible]14	2[illegible]
			2.[illegible]	7,164	10,000	3.2
			1.47	11,[illegible]	13,[illegible]10	6.7
			[illegible].33	14,60[illegible]	[illegible]7,276	31.2
			0.2[illegible]	14,[illegible]	17,614	11.[illegible]
			[illegible].00	*	*	--
[illegible]	[illegible]	1st and 1st converter	6.[illegible]	[illegible],[illegible]46	[illegible],[illegible]	--
			4.[illegible]	6,517	[illegible],[illegible]	1.[illegible]
			3.[illegible]	7,1[illegible]	[illegible].213	2.[illegible]
			2.71	[illegible],00[illegible]	[illegible]	1.7
			2.00	[illegible],[illegible]17	10,[illegible]	[illegible].7
			1.07	11,[illegible]	13,[illegible]2[illegible]	--
			[illegible].4[illegible]	12,2[illegible]	14,[illegible]35	2[illegible]
			[illegible].00	*	*	--
		2d	11.26	1,24[illegible]	[illegible]	0.[illegible]
			[illegible]	3,30[illegible]	5,[illegible]34	--
			6.[illegible]	3,[illegible]	[illegible]	2.[illegible]
		[illegible] and 3d converter	1[illegible].61	1,[illegible]	3,[illegible]	[illegible]
			[illegible].2[illegible]	[illegible]	4,[illegible]2[illegible]	2.[illegible]
			[illegible]	[illegible]	[illegible].222	2.1
			[illegible]	[illegible],474	[illegible],74[illegible]	1.[illegible]
			[illegible]	[illegible]	[illegible]	1.[illegible]
			[illegible]	4,025	[illegible]	1.7
			[illegible]	[illegible]	7,[illegible]	2.[illegible]
			[illegible]	5,702	[illegible]	2.4
			[illegible].00	7,42[illegible]	[illegible],2[illegible]	--
		M113 (Continued)				
		Carson Sink Site 2				
101	78	1st and 1st converter	3.14	0	2,423	1.4
			4.98	3.361	5,85[illegible]	2.8
			4.43	4,112	6,321	2.0
			3.94	3,936	5,834	1.9
			3.26	5.726	6,051	2.2
			2.40	7,6[illegible]4	9,681	5.4
			1.[illegible]9	9.330	10,980	2.3
			1.61	9.994	11,618	8.2
			1.6[illegible]	9,817	11.749	3.9
			0.63	12,205	12,973	43.4
			0.00	11,055	12,105	100.0
			2.35	7,805	9,887	5.6
			1.63	9,596	11,593	6.9
			1.44	10,347	12,080	7.8
			1.01	11,763	13,254	11.9
			0.50	13,045	13,94[illegible]	44.1
			0.00	11.541	12,411	100.0
10[illegible]	78S	1st and 1st converter	6.72	3.535	5,708	1.4
			4.59	4,013	6,346	0.7
			3.70	4,970	7,108	3.7
			3.47	5,365	7.495	3.2
			3.48	5,220	7,414	2.8
			1.81	8.963	10,95[illegible]	9.2
			1.25	10,938	12,386	16.4
			0.15	10,314	11.318	91.8
		3d and 3d converter	7.63	207	3,260	[illegible].2
			5.60	1,69[illegible]	4,610	[illegible].5
			[illegible].35	2,440	4.916	0.8
			4.20	2.812	5,584	4.1
			3.93	3,246	5,884	--
			3.33	3.763	6,321	3.1
			2.61	4.569	6,858	4.7
			2.20	4,879	7.289	1.3
			1.82	5.045	7,645	3.9
			1.53	5,500	7.851	--
			0.87	6.327	8.513	2.2
		Carson Sink Site 3				
103	79	1st and 1st converter	2.2[illegible]	1.913	5.247	2.0
			2.33	1.785	5.197	1.0
			2.7[illegible]	530	3.960	1.[illegible]
			3.[illegible]5	1.[illegible]	5.122	0.5
			3.72	4.0[illegible]	7.321	3.6
			[illegible]	5.463	[illegible]	4.1
			1.[illegible]	10.330	10.[illegible]	45.2
			[illegible].00	[illegible]	11.[illegible]5	100.0
			2.5[illegible]	[illegible]	9.[illegible]	[illegible]
			[illegible].62	[illegible]	11.[illegible]	9.6
			2.92	5.14[illegible]	[illegible]	[illegible].4
			2.00	7.71[illegible]	10.[illegible]	[illegible]
			2.[illegible]	5.[illegible]	[illegible].10[illegible]	4.1
			2.[illegible]	[illegible]	10.[illegible]24	13.3
			1.[illegible]	[illegible].672	11.[illegible]	[illegible]
			[illegible].00	[illegible]	11.[illegible]1	1[illegible]

(Continued)

* [illegible] the traction element and the particular ground condition.

([illegible] of 3 sheets)

Table - (Continued)

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		[illegible] (Continued)				
		[illegible]				
[illegible]	[illegible]	1st and [illegible] verter	[illegible]	[illegible]	[illegible]	[illegible]
		Four Wheel [illegible] Site				
[illegible]	[illegible]	1st and [illegible] verter	[illegible]	[illegible]	[illegible]	[illegible]
		Four Wheel [illegible] Site				
[illegible]	[illegible]	1st and [illegible] verter	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	100.0
		Nevada Pavement Site				
1??	114S	1st conv. verter	2.70	[illegible]	[illegible]	[illegible]
			2.53	[illegible]	10,493	2.5
			2.44	[illegible]	10,493	0.0
		1st	[illegible]	4,712	[illegible]	1.0
			[illegible]	[illegible]	7,352	1.7
			4.27	[illegible]	7,714	1.2
			[illegible]	[illegible]	[illegible]	1.3
		1st conv. verter	2.02	[illegible]	[illegible]	4.1
			2.16	[illegible]	[illegible]	4.7
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	2.1
			[illegible]	[illegible]	[illegible]	4.7
			[illegible]	[illegible]	[illegible]	1.5
			[illegible]	*	*	--
		1st	[illegible]	[illegible]	[illegible]	1.7

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		M1[illegible] (Continued)				
		[illegible] Pavement Site (Continued)				
[illegible]	114 (Continued)	3d	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	3,422	[illegible]
			[illegible]	[illegible]	[illegible]	1.1
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
		3d conv. verter	[illegible]	[illegible]	[illegible]	1.4
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	6,022	2.7
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	0.7
			[illegible]	[illegible]	[illegible]	2.7
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	3.0
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
		3d	[illegible]	[illegible]	4,172	[illegible]
			[illegible]	4,150	[illegible]	[illegible]
			[illegible]	2,247	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	0.2
			11.22	[illegible]	[illegible]	[illegible]
			[illegible]	4,054	[illegible]	0.5
		4th	[illegible]	1,320	2,324	--
			[illegible]	[illegible]	2,523	--
			15.69	2,070	[illegible]	--
		5th	[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	0.7
			22.4?	[illegible]	[illegible]	--
		MEXA 10x10				
		Carson Sink Site 4				
107	24	Low, 1st	3.09	0	1,774	0.6
			[illegible]	[illegible]	2,330	0.0
			[illegible]	1,751	4,007	0.5
			2.60	[illegible]	5,597	2.4
			2.45	4,251	7,263	[illegible]
			[illegible]	6,401	10,247	4.4
			1.74	[illegible]	13,426	7.2
			[illegible]	11,716	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	4.0
			[illegible]	[illegible]	[illegible]	[illegible]
			0.71	16,305	[illegible]	[illegible]
			0.34	16,666	22,425	[illegible]
			0.20	16,185	22,805	[illegible]
			0.15	17,211	23,254	[illegible]
			[illegible]	6,099	9,574	4.3
			0.47	14,464	20,582	[illegible]
			2.47	6,761	10,423	[illegible]

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		MEXA 10x10 (Continued)				
		Carson Sink Site 2				
10?	27	Low, 1st	3.14	0	1,609	3.2
			2.34	3,977	6,650	4.5
			[illegible]	7,092	10,706	5.6
			1.70	[illegible]	13,396	9.9
			1.42	11,022	15,620	[illegible]
			1.40	11,117	[illegible]	20.5
			2.35	[illegible]	[illegible]	6.4
			1.39	11,357	16,341	22.4
			0.65	13,418	[illegible]	59.1
			0.41	[illegible]	19,461	73.0
			[illegible]	13,130	18,242	[illegible]
			2.59	3,091	[illegible]	3.0
			2.17	7,044	[illegible]	6.5
			1.71	10,159	14,615	12.2
			1.03	[illegible]	17,599	31.8
			0.00	13,370	17,472	100.0
109	288	Low, 1st	5.48	0	1,414	1.9
			4.43	2,958	5,372	6.1
			4.16	3,822	6,572	4.6
			[illegible]	4,778	7,790	8.0
			2.91	7,326	10,793	7.4
			2.05	10,488	15,190	12.3
			1.37	13,514	19,208	24.2
			0.89	14,424	20,222	47.4
			0.35	15,242	21,343	77.8
			0.24	14,560	21,255	84.2
			0.01	15,470	20,855	100.0
		Low, 2d	9.96	842	3,247	4.0
			8.73	1,956	3,968	3.5
			6.82	2,844	5,090	1.1
			2.39	5,506	8,600	4.7
			0.00	6,643	9,945	--
		Carson Sink Site 4				
110	308	Low, 1st	3.79	3,946	[illegible]	--
			[illegible]	5,066	9,477	5.1
			2.37	9,932	15,210	10.4
			2.10	10,556	16,516	10.4
			2.37	10,412	16,546	0.8
			1.40	13,554	19,929	23.9
			0.95	15,066	21,499	41.8
			1.07	16,409	23,098	26.1
			0.00	16,326	24,346	100.0
		Low, 2d	12.48	480	3,939	0.5
			[illegible]	2,135	5,206	1.9
			7.56	2,753	6,776	2.6
			6.86	3,215	6,942	2.3
			5.59	4,078	7,624	2.0
			4.14	5,374	8,716	3.0
			2.70	6,813	10,052	8.7
			1.35	7,341	10,588	22.4

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		MEXA 10x10 (Continued)				
		Carson Sink Site [illegible]				
111	31	Low, 1st	2.47	[illegible]	[illegible]	2.4
			2.44	[illegible]	[illegible]	4.2
			[illegible]	[illegible]	[illegible]	[illegible]
			1.75	[illegible]	[illegible]	27.1
			0.41	5,784	[illegible]	[illegible]
			1.82	8,979	13,221	22.4
			1.37	8,355	12,743	37.0
			1.30	9,038	13,602	37.3
			1.18	9,760	15,434	42.7
			0.56	10,287	14,547	71.4
			0.00	[illegible]	14,606	100.0
			1.20	8,452	13,455	39.2
			0.81	[illegible]	[illegible]	58.0
			0.20	9,467	14,08?	87.7
			0.00	[illegible]	14,138	100.0
112	315	Low, 1st	5.72	627	3,071	0.8
			[illegible]	2,548	5,704	2.2
			4.37	3,293	[illegible]	3.4
			3.89	4,586	8,229	4.4
			3.13	6,586	10,452	7.2
			2.01	9,761	14,420	24.4
			2.22	9,055	13,679	16.1
			1.74	10,144	14,986	28.4
			2.57	7,997	12,519	10.3
			1.79	10,956	15,776	21.5
			1.38	11,446	16,478	37.0
			1.32	11,721	16,790	39.1
			0.91	12,348	17,199	54.9
			0.65	12,779	18,067	64.2
			0.36	12,897	18,613	80.8
			0.43	13,014	18,613	76.3
		Low, 2d	10.50	1,274	4,202	0.5
			11.04	1,450	4,144	--
			6.53	3,776	6,347	3.6
			4.31	4,626	7,888	3.5
			3.77	4,822	8,512	3.6
			3.28	5,096	9,009	6.2
			2.81	5,606	9,380	4.5
			2.40	5,900	9,584	4.1
			2.05	6,390	10,072	4.4
			1.43	6,860	10,637	3.0
			0.83	7,252	11,125	5.9

(Continued)

* The vehicle's power train could not develop enough force to produce 100% slip between the traction element and the particular ground condition.

Table [illegible] (Continued)

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		MEXA 10x10 (Continued)				
		Four Mile Flat Site [illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		MEXA 10x10 (Continued)				
		Four Mile Flat Site [illegible]				
11[illegible]	17[illegible]	Low, 1st	4.15	0	2,138	[illegible]
			[illegible]	[illegible]	2,500	5.0
			[illegible]	1,714	[illegible]	13.4
			[illegible]	[illegible]	3,757	[illegible]
			[illegible]	[illegible]	4,534	[illegible]
			0.73	3,281	5,321	75.2
			[illegible]	[illegible]	5,146	87.4
			[illegible]	4,109	[illegible]	100.0
		Low, 2d	[illegible]	[illegible]	2,460	6.3
			[illegible]	[illegible]	[illegible]	7.8
			[illegible]	[illegible]	2,564	[illegible]
			[illegible]	77[illegible]	2,575	[illegible]
			4.77	1,44[illegible]	3,108	[illegible]
			[illegible]	[illegible]	3,575	5.8
			[illegible]	2,73[illegible]	4,705	[illegible]
			[illegible]	[illegible]	4,858	30.2
			[illegible]	[illegible]	5,532	[illegible]
			[illegible]	[illegible]	5,70[illegible]	85.[illegible]
		High, 1st	[illegible]	[illegible]	2,815	7.[illegible]
			[illegible]	[illegible]	[illegible]	12.5
			2.73	815	[illegible]	[illegible]
			[illegible]	1,447	[illegible]	20.8
			1.81	[illegible]	4,403	15.3
			[illegible]	[illegible]	4,215	10.1
			1.44	[illegible]	4,58[illegible]	7.1
			[illegible]	[illegible]	5,05[illegible]	--
			[illegible]	2,74[illegible]	5,047	[illegible]
11[illegible]	17[illegible]	Low, 1st	[illegible]	115	1,845	[illegible]
			3.77	[illegible]	[illegible]	5.4
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	1,732	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	12.7
			[illegible]	[illegible]	[illegible]	24.5
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	2,577	[illegible]	[illegible]
			1.77	[illegible]	[illegible]	47.5
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	4,214	5,774	100.0

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		MEXA 10x10 (Continued)				
		Four Mile Flat Site 9				
117	128	Low, 1st	3.77	1,860	2,706	2.1
			3.24	3,497	4,991	2.1
			2.38	6,689	8,610	4.0
			1.86	8,937	10,929	8.2
			1.29	11,713	14,205	15.3
			0.81	12,545	15,017	41.3
			0.00	14,460	16,325	100.0
			1.11	11,935	14,283	26.5
			0.00	14,155	16,191	100.0
			4.82	135	907	0.1
			4.06	1,242	2,070	1.0
			3.35	2,539	3,862	1.4
			3.11	3,322	4,605	1.2
			2.56	4,700	6,209	4.5
			2.00	6,050	7,740	4.9
			1.49	8,130	10,226	7.4
			0.74	9,345	11,670	13.2
			0.23	12,425	15,264	48.5
			0.23	12,641	15,865	54.1
			0.72	11,992	13,498	40.1
			0.00	14,477	16,915	100.0
		Four Mile Flat Site 6				
118	159A	Low, 1st	0.34	305	3,571	14.0
			1.77	6,434	8,614	18.3
			1.48	5,872	8,113	13.8
			1.89	6,593	8,965	13.8
			1.61	7,833	10,368	18.2
			1.28	7,921	10,693	30.0
			0.00	10,349	11,368	100.0
			1.07	7,089	9,617	50.1
			0.54	8,446	10,320	73.1
			0.27	7,789	10,190	86.4
119	159B	Low, 1st	0.65	65	1,779	14.9
			2.02	2,815	2,405	11.5
			2.15	4,057	3,547	14.9
			2.32	6,133	5,038	16.8
			2.40	5,915	4,947	19.7
			2.01	5,718	4,723	34.2
			1.55	5,107	4,321	50.1
			1.21	4,627	4,056	64.0
			0.73	4,321	3,922	78.1
			0.45	4,354	4,125	87.7
			0.90	4,105	3,838	73.5
			0.65	4,452	3,895	80.4
			0.35	4,430	3,986	88.2
			0.00	4,976	4,144	100.0

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		MEXA 10x10 (Continued)				
		Four Mile Flat Site 6 (Continued)				
120	163A	Low, 1st	1.94	382	2,210	4.8
			2.04	922	2,311	4.0
			2.10	2,070	3,610	4.0
			2.03	2,745	4,655	15.3
			1.67	3,161	5,656	28.6
			1.25	2,171	5,581	45.2
			1.02	1,215	5,262	55.5
			0.00	1,339	4,248	100.0
121	163B	Low, 1st	2.05	731	2,984	7.9
			2.27	1,260	3,524	7.7
			2.36	2,216	3,929	10.6
			1.87	2,520	4,394	27.9
			1.63	2,498	4,614	37.4
			1.27	1,969	4,783	51.1
			0.88	2,025	5,088	65.5
			0.69	2,092	5,250	73.1
			0.00	3,532	5,740	100.0
122	164	Low, 1st	3.20	1,630	3,549	10.4
			3.29	1,144	3,124	8.6
			3.00	2,364	4,001	11.7
			2.70	2,440	4,396	19.0
			2.37	1,965	4,236	33.5
			1.56	2,278	4,862	55.1
			0.97	2,871	5,208	70.4
			0.87	3,055	5,238	73.9
			0.68	3,238	5,176	79.1
			0.00	4,080	5,333	100.0
			1.96	2,785	4,909	42.5
			2.17	3,249	5,133	33.2
			1.38	3,713	5,452	55.6
			0.91	3,854	5,265	44.5
			0.00	4,124	5,403	100.0

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(Continued)

Table [illegible] (Continued)

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		M2XA 6x6 (Continued)				
		Carson Sink Site 5				
[illegible]	[illegible]	Low, 1st	[illegible]	[illegible]	--	0.7
			[illegible]	[illegible]	--	2.7
			[illegible]	2,210	--	[illegible]
			[illegible]	3,261	--	3.1
			[illegible]	4,055	--	[illegible]
			2.65	[illegible]	--	6.1
			2.42	5,443	--	6.5
			1.88	7,[illegible]81	--	6.4
			1.65	8,53[illegible]	--	12.2
			1.38	9,934	--	13.9
			1.15	10.792	--	20.5
			1.01	11,071	--	27.0
			[illegible]	11,74[illegible]	--	45.6
			[illegible].12	11,[illegible]40	--	[illegible]
			1.34	[illegible],655	--	1[illegible].2
			1.[illegible]4	[illegible],891	--	10.3
			1.[illegible]4	10,728	--	30.0
			0.[illegible]6	11,264	--	2[illegible].7
			0.71	11,607	--	45.2
			0.24	11,714	--	81.0
			0.19	11.672	--	85.2
1[illegible]7	105S	Low, 1st	5.[illegible]7	215	--	0.0
			3.77	3,175	--	2.0
			2.82	5.664	--	4.4
			1.98	9.526	--	8.7
			1.40	11,672	--	10.2
			1.08	12,616	--	28.8
			0.00	12,959	--	100.0
		Low, 2d	6.81	429	--	0.1
			5.46	1,974	--	0.1
			4.66	2,575	--	1.0
			4.55	3,476	--	1.6
			3.55	5,063	--	3.1
			2.73	6,436	--	5.1
			0.84	9,440	--	14.1
			0.84	9,569	--	12.9
			0.65	9,741	--	16.6
			0.49	9,955	--	22.6
			0.12	9,826	--	81.8
		High, 1st	6.48	2,477	--	--
			4.15	3.303	--	1.6
			3.17	3.803	--	2.5
			2.12	4.389	--	2.7
			1.67	4,498	--	2.5
			1.46	4,520	--	3.0
			0.00	5.737	--	--
		High, 2d	6.87	1.695	--	--
			2.85	1.760	--	0.8
			2.96	1,891	--	2.9
			2.50	2,282	--	--
			1.75	2.115	--	0.3
			0.00	2,347	--	--

Item No.	Test No.	Range and Transmission	Speed mph	Drawbar Pull lb	Force Computed from Torque lb	Slip %
		M2XA 6x6 (Continued)				
		Carson Sink Site 4				
1[illegible]5	10[illegible]S	Low, 1st	5.5[illegible]	372	--	--
			3.57	3,595	--	2.3
			2.48	5,516	--	3.8
			2.67	5.570	--	5.3
			2.29	7,[illegible]6	--	8.3
			1.41	9.731	--	8.7
			1.05	13,512**	--	24.8
		Low, 2d	8.77	0	--	0.[illegible]
			5.43	2,851	--	3.4
			4.33	3,[illegible]7	--	2.0
			3.40	5.330	--	2.2
			2.46	6,6[illegible]4	--	4.8
			1.05	[illegible],359	--	0.9
		High, 1st	11.11	291	--	--
			9.50	1,810	--	0.1
			7.09	2,330	--	1.8
			5.63	2,933	--	1.5
			4.01	3,827	--	2.[illegible]
			3.06	4,430	--	2.[illegible]
			1.77	5.346	--	1.8
			0.00	6.115	--	--
		High, 2d	13.06	166	--	--
			6.34	1,726	--	--
			3.20	2,038	--	--
			1.36	2,4[illegible]6	--	--
		Four Mi'e Flat Site 6				
129	153S	Low, 1st	3.82	256	--	6.8
			3.23	1,661	--	14.0
			2.92	2,240	--	14.5
			2.61	2,678	--	20.9
			2.00	3,356	--	32.7
			1.56	2,628	--	41.5
		Low, 2d	3.79	124	--	13.6
			3.53	537	--	13.6
			3.24	1,306	--	14.9
			2.16	1,893	--	27.2
			1.64	2,141	--	30.3
			0.93	2,356	--	55.8
			0.86	2,603	--	58.3
130	154	Low, 1st	3.35	51	--	6.5
			2.89	1,149	--	9.9
			2.96	1,645	--	12.1
			2.87	2,339	--	13.8
			2.58	2,802	--	19.8
			1.74	2,686	--	39.5
			1.31	2,339	--	50.4

(Continued)

** At this pull [illegible] and [illegible] differentials failed.

(5 of 8 sheets)

Table 4 (Continued)

Item No.	Test No.	Range and Trans-mission	Speed mph	Draw-bar Pull lb	Force Com-puted from Torque lb	Slip %
		MEXA 8x8 (Continued)				
		Four Mile Flat Site [illegible] (Continued)				
[illegible]	157	Low, 1st	1.5[illegible]	41	--	10.7
			4.17	80[illegible]	--	[illegible].6
			[illegible]	1,[illegible]	--	11.3
			[illegible]	1,7[illegible]0	--	2[illegible].7
			1.[illegible]3	1,44[illegible]	--	[illegible].0
			1.[illegible]	1,57[illegible]	--	[illegible].4
			0.63	1,5[illegible]0	--	[illegible]
			[illegible]	1,7[illegible]	--	100.0
			[illegible]	41[illegible]	--	[illegible]
			1.[illegible]	477	--	[illegible]
			[illegible].47	[illegible]	--	[illegible].0
			0.0[illegible]	1,[illegible]	--	100.0
		Nevada Pavement Site				
[illegible]	1112	Low, 1st	[illegible]	[illegible]	--	0.0
			[illegible].75	44[illegible]	--	0.[illegible]
			5.10	1,4[illegible]7	--	0.0
			4.[illegible]4	[illegible],74[illegible]	--	0.7
			4.17	4,00[illegible]	--	1.0
			[illegible]	4,[illegible]07	--	1.2
			[illegible]	[illegible],[illegible]47	--	1.8
			[illegible].41	7,[illegible]	--	1.0
			[illegible]	[illegible]	--	1.1
		Low, 2d	10.7[illegible]	0	--	[illegible].0
			[illegible]	1,[illegible]	--	[illegible]
			[illegible]	1,[illegible]	--	0.[illegible]
			7.[illegible]	2,44[illegible]	--	0.[illegible]
			[illegible]	2,[illegible]43	--	--
			[illegible]	[illegible]	--	0.4
			[illegible]	[illegible],17[illegible]	--	1.0
			[illegible]	[illegible]	--	0.[illegible]
			[illegible].97	[illegible],1[illegible]	--	[illegible].0
			[illegible]	7,[illegible]1	--	[illegible]
			1.[illegible]	[illegible]	--	1[illegible].8
			[illegible].7[illegible]	1[illegible],[illegible]	--	--
		High, 1st	1[illegible].10	[illegible]	--	0.[illegible]
			1[illegible].[illegible]7	[illegible]	--	0.[illegible]
			1[illegible]	[illegible]	--	0.[illegible]
			1[illegible].44	1,[illegible]	--	0.[illegible]
			11.4[illegible]	[illegible],1[illegible]7	--	[illegible]
			[illegible]	[illegible]	--	0.[illegible]
			7.74	[illegible],[illegible]	--	--
			[illegible]	[illegible]	--	--
			[illegible]	[illegible]	--	1.7
			[illegible].44	[illegible]	--	0.[illegible]
			1.4[illegible]	[illegible],[illegible]10	--	0.6
			0.[illegible]	[illegible]	--	--
		MEXA 8x8 (Continued)				
		Nevada Pavement Site (Continued)				
[illegible] (Continued)	1112	High, 2d	19.47	860	--	0.0
			16.17	907	--	0.0
			16.41	1,362	--	0.0
			13.95	1,430	--	0.0
			11.63	2,104	--	2.7
			9.27	2,186	--	--
			6.77	2,697	--	0.5
			4.26	2,732	--	0.8
			2.92	3,464	--	2.6
			1.67	3,441	--	--
			1.25	3,429	--	1.5
			0.00	3,708	--	--
		MEXA Track				
		Carson Sink Site 4				
132	35	Low, 1st	3.77	307	2,435	2.7
			3.75	179	2,410	3.1
			3.64	2,125	4,507	2.1
			3.31	3,533	5,864	1.9
			2.67	5,684	8,260	2.5
			2.16	7,733	10,178	1.6
			1.38	10,600	13,212	3.6
			1.37	11,497	13,549	2.6
			1.31	11,727	13,282	4.3
			1.01	13,724	15,491	7.0
			1.11	12,700	14,743	4.9
			0.62	15,894	17,567	25.8
			1.17	13,980	16,137	14.3
			0.77	16,951	18,153	26.9
			0.54	16,436	17,222	40.2
			0.16	19,869	20,359	78.1
			0.24	19,972	20,761	63.1
133	358	Low, 1st	4.07	1,950	3,872	5.8
			4.60	2,052	4,193	2.6
			4.83	1,984	4,024	2.7
			4.78	2,300	4,204	2.2
			3.64	4,823	7,009	1.3
			3.16	5,926	8,154	1.6
			2.44	8,723	11,270	3.0
			1.51	13,443	15,129	11.2
			1.16	14,726	16,388	15.0
			0.76	16,547	18,007	28.8
			1.55	12,904	14,755	6.0
			0.46	18,472	19,469	47.4
			0.33	19,137	19,966	57.1
			0.31	19,754	20,311	54.9
			0.00	20,140	20,890	100.0
		MEXA Track (Continued)				
		Carson Sink Site 4 (Continued)				
133 (Continued)	358	High, 1st	6.55	2,052	4,338	1.6
			5.25	3,027	4,921	1.3
			3.57	4,028	6,045	--
			3.16	4,130	5,290	--
			2.80	4,156	6,539	3.0
			2.22	4,874	6,671	1.8
			1.68	5,336	7,055	2.1
			1.26	6,106	7,289	--
			0.71	6,388	7,623	5.7
		High, 2d	6.91	1,334	3,039	1.4
			7.05	2,104	3,039	0.4
			7.81	1,231	2,930	0.0
			5.90	3,207	3,378	0.6
			3.82	3,515	3,684	0.7
			3.36	4,156	3,783	0.7
			2.50	4,618	3,801	2.2
			2.33	3,386	3,851	1.3
			2.60	3,592	3,746	0.4
			2.54	4,028	3,746	1.1
			2.28	4,874	3,816	--
			1.74	5,541	3,923	--
			1.00	5,644	4,018	--
		Carson Sink Site 2				
134	38	Low, 1st	3.70	235	2,264	0.0
			3.76	0	1,978	0.0
			2.97	1,647	3,910	4.0
			3.03	1,831	4,273	1.3
			2.79	3,503	6,193	1.4
			2.66	5,751	8,274	1.4
			2.42	7,502	9,946	0.4
			2.22	8,940	11,502	1.2
			2.31	8,861	11,257	1.9
			1.61	11,815	14,140	6.3
			1.14	13,776	15,927	17.6
			1.73	10,613	13,466	5.5
			1.75	10,979	12,993	5.5
			2.70	6,953	9,134	0.4
			1.37	12,809	15,023	10.1
			1.24	13,384	15,296	15.6
			0.81	13,645	16,242	41.8
			1.20	12,861	15,852	20.2
			0.83	13,750	16,480	41.3
			0.32	14,116	16,913	76.5
			0.23	14,011	16,761	82.1
		MEXA Track (Continued)				
		Carson Sink Site 2 (Continued)				
135	388	Low, 1st	4.92	1,127	3,479	4.7
			4.71	2,334	4,344	1.4
			3.95	3,836	5,968	0.8
			3.20	5,955	8,094	1.0
			2.40	8,691	10,732	3.3
			1.97	10,864	12,916	--
			1.46	13,091	14,940	7.0
			1.22	14,056	15,929	11.9
			1.09	14,432	16,199	18.0
			1.47	12,769	14,642	8.7
			1.06	14,593	16,508	22.5
			0.37	15,398	17,662	70.2
			0.36	16,041	18,308	68.2
		High, 1st	6.97	1,348	3,017	--
			5.37	2,141	3,803	0.9
			4.26	3,199	4,807	1.1
			3.21	3,860	5,530	0.0
			3.16	3,648	5,510	0.0
			2.28	4,653	5,959	0.4
			1.57	4,996	6,336	0.4
			0.96	5,419	6,812	4.0
		High, 2d	7.02	721	2,719	2.1
			7.08	708	2,738	1.7
			5.20	1,615	3,080	0.9
			3.15	1,762	3,368	0.4
			2.72	1,922	3,470	--
			1.69	2,310	3,600	2.7
			1.08	2,884	3,749	--
		Carson Sink Site 2				
136	41	Low, 1st	3.78	1,100	4,066	0.0
			2.97	4,936	8,732	1.8
			2.76	6,549	10,237	3.5
			2.41	8,308	12,009	3.3
			2.06	9,725	13,485	4.6
			2.00	10,067	13,547	5.2
			1.16	12,975	16,015	27.3
			0.81	12,511	16,578	49.2
			2.41	8,283	11,952	0.8
			1.62	11,827	14,983	8.5
			0.66	12,071	16,470	61.8
			1.39	12,315	16,421	45.7
			0.83	12,193	15,980	55.0
			1.23	13,244	16,387	21.2
			1.14	13,195	16,119	30.3
			0.00	13,439	17,0[illegible]4	100.0

(Continued)

(6 of 8 sheets)

[illegible]

Site No.	Test No.	Gear and range	Speed mph	Drawbar pull lb	Measured torque lb	Slip %
		[illegible] Track (Continued)				
		[illegible]				
[illegible]	[illegible]	Low, 1st	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	7.741	[illegible]	[illegible]
			[illegible]	[illegible]	11.770	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	11.7
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			1.77	[illegible]	[illegible]	[illegible]
1-1	[illegible]	Low, 1st	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			2.57	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			1.56	[illegible]	[illegible]	4.5
			[illegible]	[illegible]	[illegible]	[illegible]
			1.05	[illegible]	14,832	[illegible]
			[illegible]	13,711	15,237	[illegible]
			[illegible]	[illegible]	15,520	21.4
			1.42	12,377	[illegible]	[illegible]
			0.00	[illegible]	[illegible]	100.0
		Low, 2d	[illegible]	[illegible]	[illegible]	2.1
			[illegible]	[illegible]	[illegible]	1.2
			[illegible]	[illegible]	[illegible]	2.6
			3.05	5.177	[illegible]	[illegible]
			2.30	[illegible]	8.882	[illegible]
			[illegible]	[illegible]	[illegible]	3.3
			1.74	[illegible]	10,073	3.3
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	12.471	--
		High, 1st	[illegible]	[illegible]	4.565	[illegible]
			[illegible]	1,870	[illegible]	[illegible]
			5.30	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			2.24	4.007	7.539	2.2
			1.88	[illegible]	[illegible]	--
			[illegible]	4.141	[illegible]	[illegible]
			0.00	[illegible]	9,332	100.0
		High, 2d	[illegible]	312	3,237	1.2
			5.31	1,425	[illegible]	0.8
			2.93	1.514	4,418	1.3
			2.55	1.425	[illegible]	1.3
			[illegible]	[illegible]	[illegible]	--

Site No.	Test No.	Gear and range	Speed mph	Drawbar pull lb	Measured torque lb	Slip %
		[illegible] Track (Continued)				
		Four Mile Flat Site [illegible]				
[illegible]	[illegible]	Low, 1st	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			1.57	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
		Low, 2d	[illegible]	[illegible]	[illegible]	[illegible]
			3.12	[illegible]	[illegible]	[illegible]
			[illegible]	623	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	2.7
			[illegible]	[illegible]	[illegible]	[illegible]
			1.85	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Low, 1st	2.74	[illegible]	[illegible]	[illegible]
			2.38	[illegible]	11.175	[illegible]
			2.12	[illegible]	[illegible]	12.1
			[illegible]	[illegible]	[illegible]	[illegible]
			1.07	3.323	15,351	[illegible]
			0.31	3.522	[illegible]	[illegible]
			0.00	[illegible]	[illegible]	100.0
			[illegible]	[illegible]	14,266	[illegible]
			1.02	[illegible]	15,626	48.8
			0.00	[illegible]	[illegible]	100.0
		Four Mile Flat Site 7				
[illegible]	136	Low, 1st	[illegible]	424	[illegible]	23.1
			[illegible]	315	[illegible]	55.7
			[illegible]	1.176	15,913	[illegible]
			[illegible]	2,336	16,225	81.8
			1.46	[illegible]	15,048	25.1
			[illegible]	[illegible]	16.508	64.1
			0.51	1.627	16,424	72.0
			[illegible]	1,381	16.383	[illegible]
			0.67	1.832	16,006	64.0
			0.29	2,462	16.440	84.1
			[illegible]	[illegible]	17,252	[illegible]
			0.15	[illegible]	17,473	[illegible]

(Continued)

(7 of 8 sheets)

Table 4 (Concluded)

Item No.	Test No.	Range and Trans- mission	Speed mph	Draw- bar Pull lb	Force Com- puted from Torque lb	Slip %
[illegible] Continued						
[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	--
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--
			[illegible]	[illegible]	[illegible]	--

Item No.	Test No.	Range and Trans- mission	Speed mph	Draw- bar Pull lb	Force Com- puted from Torque lb	Slip %

Item No.	Test No.	Range and Trans- mission	Speed mph	Draw- bar Pull lb	Force Com- puted from Torque lb	Slip %

Item No.	Test No.	Range and Trans- mission	Speed mph	Draw- bar Pull lb	Force Com- puted from Torque lb	Slip %

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Table [illegible]

Summary of Soil Data for Speed Tests

[illegible left-hand columns]	Avg Cone Index of Layers, in. 0-6	6-12	12-18	Remolding Index of Layers, in. 0-6	6-12	12-18	Rating Cone Index of Layers, in. 0-6	6-12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	1-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph Vane c	Vane φ°	Vane s_v	Rubber a	Rubber φ°	Rubber s_r	Avg Rut Depth in.
Military Vehicles																							
2-1/2-Ton M34[illegible], [illegible] Truck, Test Weight 1[illegible] lb																							
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.[illegible]	0.54	[illegible]	40	[illegible]	21.2	[illegible]	[illegible]	74.9	75.5	[illegible]	55.0	[illegible]	29	12.8	1.2	[illegible]	12.2	1.8
[illegible]	[illegible]	[illegible]	[illegible]	0.77	0.75	[illegible]	[illegible]	34	[illegible]	19.0	28.3	[illegible]	76.2	78.3	67.2	52.4	2.7	28	11.8	1.0	28	10.0	1.9
[illegible]	[illegible]	[illegible]	25	0.71	0.71	0.[illegible]	24	20	[illegible]	20.2	[illegible]	[illegible]	59.9	89.9	79.4	62.0	3.5	26	11.7	0.8	28	9.7	[illegible]
[illegible]	102	[illegible]	77	1.85	0.89	0.75	189	77	58	9.8	28.0	73.8	97.8	76.3	55.9	45.2	2.9	44	19.4	1.0	39	14.8	0.5
2-1/2-Ton M35A2 (mod), 6x6 Truck, Test Weight 18,225 lb																							
[illegible]	[illegible]	45	[illegible]	0.72	0.77	0.55	35	35	20	21.4	28.3	51.8	79.6	88.8	66.6	51.7	3.0	26	17.5	1.0	26	14.5	5.3
[illegible]	[illegible]	[illegible]	59	0.74	[illegible]	0.54	[illegible]	40	32	21.2	38.4	64.2	74.9	75.5	60.5	55.0	3.5	29	15.7	1.2	33	19.0	3.4
[illegible]	[illegible]	[illegible]	[illegible]	0.77	0.78	0.59	35	34	19	19.0	28.3	46.8	76.2	76.3	67.2	52.4	2.7	28	17.4	1.0	28	15.6	5.8
[illegible]	102	[illegible]	77	1.85	0.89	0.75	189	77	58	9.8	28.0	73.8	97.8	76.3	55.9	45.2	2.9	44	29.7	1.0	39	23.5	1.0
M113 APC, Full Tracked, Test Weight 22,600 lb																							
[illegible]	[illegible]	[illegible]	58	0.74	[illegible]	0.54	50	40	31	21.2	38.4	64.2	74.9	75.5	60.5	55.0	3.5	29	7.4	1.2	33	5.8	1.8
[illegible]	[illegible]	[illegible]	[illegible]	0.77	0.78	0.59	35	34	19	19.0	28.3	46.8	76.2	78.3	67.2	52.4	2.7	28	6.5	1.0	28	4.8	2.3
[illegible]	[illegible]	28	27	0.71	0.71	0.66	24	20	13	20.2	26.2	36.8	59.9	89.9	79.4	62.0	3.5	26	7.0	0.8	28	4.6	2.8
[illegible]	102	87	77	1.85	0.89	0.75	189	77	58	9.8	28.0	73.8	97.8	76.3	55.9	45.2	2.9	44	9.7	1.0	39	6.7	1.0
[illegible]	29	33	[illegible]	0.61	[illegible]	0.60	18	21	26	36.0	58.4	38.7	36.0	82.9	75.1	79.2	2.7	4	3.2	1.0	25	4.3	5.4
MEXA Vehicles																							
2-1/2-Ton MEXA, 10x10 Truck, Test Weight 18,030 lb																							
[illegible]	48	45	[illegible]	0.72	0.77	0.55	35	35	20	21.4	28.3	51.8	79.6	88.8	66.6	51.7	3.0	26	6.6	1.0	26	4.3	0.6
[illegible]	30	[illegible]	26	0.68	0.68	0.68	20	12	18	19.7	26.3	38.6	64.6	90.7	77.7	58.0	3.3	26	6.8	0.8	28	4.5	0.7
[illegible]	60	[illegible]	55	[illegible]	[illegible]	0.62	52	[illegible]	34	19.9	38.6	58.4	72.5	63.4	64.3	55.9	3.2	28	6.8	1.0	30	4.9	0.6
[illegible]	105	[illegible]	[illegible]	[illegible]	0.73	0.69	174	68	61	8.8	27.5	72.4	97.2	77.4	56.4	47.8	4.6	46	11.7	2.0	37	7.5	0.0
[illegible]	21	20	25	0.52	0.62	0.72	11	12	18	47.1	47.6	48.5	52.0	72.3	68.3	65.6	2.7	9	3.7	0.5	13	2.0	0.4
[illegible]	74	75	32	0.93	0.69	0.64	69	52	52	19.4	28.6	78.0	89.4	--	55.2	48.6	4.6	38	10.0	0.6	36	5.6	--
2-1/2-Ton, MEXA, 8x8 Truck, Test Weight 1[illegible],013 lb																							
[illegible]	46	44	38	0.72	0.77	0.55	33	34	21	21.4	28.3	51.8	79.6	88.8	66.6	51.7	3.0	26	7.5	1.0	26	5.2	1.1
[illegible]	28	25	25	0.68	0.68	0.68	19	[illegible]	17	19.7	26.3	38.6	64.6	90.7	77.7	58.0	3.4	27	7.8	0.8	28	5.5	1.7

(Continued)

* c indicates cohesion, psi.
φ indicates angle of friction, deg.
s_v and s_r indicate values, in psi, for the vane head and rubber head, respectively, read from shear stress/normal stress curves at normal ground contact pressure.
a indicates soil-to-rubber adhesion, psi.

Table 5 (Concluded)

Item No.	Site Location and No.	Test No.	Max Stress psi	Cone Index at Depth, in.: [illegible]	1	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	[illegible]	[illegible]	[illegible]	Avg Cone Index of Layers, in.: 0-6	6-12	12-18	Remolding Index of Layers, in.: 0-6	6-12	12-18	Rating Cone Index of Layers in.: 0-6	6-12	12-18	Moisture Content (% Dry Wt) of Layers, in.: 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in.: 0-6	6-12	12-18	Sheargraph* Vane: c	Vane: φ°	Vane: S_v	Rubber: a	Rubber: φ°	Rubber: S_r	Avg Rut Depth in.
MEXA Vehicles (Continued)																																						
2-1/2-Ton MEXA, 8x8 Truck, Test Weight 19,01[illegible] lb (Continued)																																						
	Carson Flat:																																					
[illegible]	Site [illegible]	[illegible]	[illegible]	72	[illegible]	[illegible]	[illegible]	[illegible]	71	[illegible]	[illegible]	[illegible]	[illegible]	51	--	[illegible]	[illegible]	[illegible]	0.72	0.70	0.57	49	42	31	26.2	42.6	56.8	86.2	67.6	64.8	50.3	3.2	31	8.4	0.9	36	7.1	0.8
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27	[illegible]	--	[illegible]	40	32	[illegible]	0.79	0.53	29	32	17	18.6	26.1	49.0	75.8	87.5	68.3	50.3	3.1	26	7.3	0.8	30	5.8	1.0
[illegible]	Site [illegible]	[illegible]	17.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24	30	--	[illegible]	29	28	0.71	0.71	0.66	21	20	22	20.2	26.2	36.8	59.9	89.9	79.4	62.0	3.5	26	7.7	0.8	25	5.6	1.7
	Four Mile Flat:																																					
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25	28	32	0.65	0.80	0.72	16	22	23	45.5	43.1	41.8	33.0	73.4	73.6	78.2	2.8	10	4.2	2.0	8	3.2	0.8
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	41	[illegible]	20	25	40	0.75	0.77	0.69	15	19	21	47.9	48.0	46.8	48.2	69.9	72.7	72.8	2.3	9	3.7	1.3	9	2.7	0.7
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20	24	0.58	0.72	0.69	12	14	18	44.0	53.2	49.8	51.0	64.6	68.8	67.0	3.8	8	5.0	1.6	12	3.4	0.8
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22	25	[illegible]	0.72	0.74	12	16	18	41.7	53.3	50.4	51.5	67.4	68.4	67.0	4.9	5	5.6	1.8	16	4.3	0.8
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	27	[illegible]	[illegible]	0.90	0.75	15	22	21	53.9	47.2	46.4	50.4	72.0	73.6	69.1	1.8	4	2.4	1.7	5	2.4	1.0
2-1/2-Ton MEXA Track, Test Weight, 19,680 lb																																						
	Carson Flat:																																					
[illegible]	Site [illegible]	[illegible]	22.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	[illegible]	[illegible]	[illegible]	[illegible]	0.64	0.54	[illegible]	40	32	21.2	38.4	67.2	74.9	75.5	60.5	55.0	3.5	29	4.9	1.2	33	2.8	0.8
[illegible]	Site [illegible]	[illegible]	22.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	32	[illegible]	30	--	[illegible]	[illegible]	30	[illegible]	0.71	[illegible]	41	28	20	19.3	23.2	47.4	58.1	92.9	70.8	47.7	2.8	27	4.1	1.2	24	2.4	1.6
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	[illegible]	[illegible]	[illegible]	0.71	0.71	[illegible]	24	20	13	20.2	26.2	36.8	59.9	89.9	79.4	62.0	3.5	26	4.7	0.8	28	2.2	1.3
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	--	[illegible]	[illegible]	72	[illegible]	[illegible]	0.75	[illegible]	72	54	[illegible]	28.0	73.6	97.8	76.3	[illegible]	45.2	2.9	44	5.4	1.0	39	3.1	0.4
	Four Mile Flat:																																					
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24	[illegible]	[illegible]	17	[illegible]	[illegible]	0.59	0.75	0.78	[illegible]	14	20	41.4	50.4	47.4	50.5	[illegible]	70.0	68.0	2.7	7	2.7	2.0	6	2.2	[illegible]
[illegible]	Site [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	[illegible]	[illegible]	[illegible]	[illegible]	11	15	[illegible]	[illegible]	50.7	57.5	61.6	[illegible]	[illegible]	1.7	11	2.2	1.2	12	1.8	[illegible]

Table 6

Summary of Soil Data for Maneuver Tests

[illegible]	[illegible]	[illegible]	[illegible]	Cone Index at Depths, in.												Avg Cone Index of Layers, in. 0-6	6-12	12-18	Remolding Index of Layers, in. 0-6	6-12	12-18	Rating Cone Index of Layers, in. 0-6	6-12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph* Vane c	Vane φ°	Vane S_v	Rubber a	Rubber φ°	Rubber S_r	Avg Rut Depth in.
																2-1/2-Ton XM410E1, 8x8 Truck, Test Weight 16,504 lb																						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55	0.74	0.62	0.60	44	36	33	16.0	39.4	55.5	59.8	68.8	64.6	62.2	[illegible]	[illegible]	13.6	0.7	32	11.5	1.4
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55	0.74	0.62	0.60	44	36	33	16.0	39.4	55.5	59.8	68.8	64.6	62.2	[illegible]	33	14.9	0.9	33	12.0	1.4
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55	0.74	0.62	0.60	44	36	33	16.0	39.4	55.5	59.8	68.8	64.6	62.2	[illegible]	26	12.6	1.2	32	11.9	1.4
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55	0.74	0.62	0.60	44	36	33	16.0	39.4	55.5	59.8	68.8	64.6	62.2	--	--	--	--	--	--	--
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37	[illegible]	29	0.79	0.71	0.68	29	27	20	18.3	23.2	47.4	88.1	92.9	70.8	47.7	2.2	28	11.3	0.4	30	10.3	1.4
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37	[illegible]	29	0.79	0.71	0.68	29	27	20	18.3	23.2	47.4	88.1	92.9	70.8	47.7	3.3	26	11.6	0.0	32	9.9	1.4
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37	[illegible]	29	0.79	0.71	0.68	29	27	20	18.3	23.2	47.4	88.1	92.9	70.8	47.7	3.3	26	11.6	0.8	28	10.0	1.4
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37	[illegible]	29	0.79	0.71	0.68	29	27	20	18.3	23.2	47.4	88.1	92.9	70.8	47.7	--	--	--	--	--	--	--
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	32	25	25	0.76	0.80	0.64	24	22	18	20.0	25.2	32.8	52.2	89.6	82.8	68.0	3.3	25	10.9	0.0	33	11.1	2.2
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	32	25	[illegible]	0.76	0.80	0.64	24	22	18	20.0	25.2	32.8	52.2	89.6	82.8	68.0	3.2	26	11.5	0.9	30	10.8	2.4
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	32	25	[illegible]	0.76	0.80	0.64	24	22	18	20.0	25.2	32.8	52.2	89.6	82.8	68.0	2.9	26	11.2	1.2	25	9.1	2.0
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	32	25	[illegible]	0.76	0.80	0.64	24	22	18	20.0	25.2	32.8	52.2	89.6	82.8	68.0	--	--	--	--	--	--	--
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	88	70	1.83	0.84	0.68	194	74	46	11.7	29.8	54.1	99.5	72.8	65.4	44.3	4.2	48	23.2	0.0	44	16.5	0.5
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	88	70	1.83	0.84	0.68	194	74	48	11.7	29.8	54.1	99.5	72.8	65.4	44.3	5.0	43	20.8	1.6	43	17.5	0.5
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	88	70	1.83	0.84	0.68	194	74	48	11.7	29.8	54.1	99.5	72.8	65.4	44.3	5.7	46	22.6	1.2	43	17.0	0.4
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	88	70	1.83	0.84	0.68	194	74	48	11.7	29.8	54.1	99.5	72.8	65.4	44.3	--	--	--	--	--	--	--
																2-1/2-Ton M35A2 (mod), 6x6 Truck, Test Weight 18,225 lb																						
[illegible]	Carson Sink site [illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57	58	59	58	61	62	59	58	0.74	0.62	0.60	46	27	35	16.0	39.4	55.5	59.8	68.8	64.6	62.2	2.5	26	16.0	2.2	25	15.2	2.6
[illegible]			2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57	58	59	58	61	62	59	58	0.74	0.62	0.60	46	27	35	16.0	39.4	55.5	59.8	68.8	64.6	62.2	2.2	27	16.4	0.8	31	17.5	2.9
[illegible]			3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57	58	59	58	61	62	59	58	0.74	0.62	0.60	46	27	35	16.0	39.4	55.5	59.8	68.8	64.6	62.2	3.1	31	20.0	2.0	27	16.1	2.8
[illegible]			4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57	58	58	58	61	62	59	58	0.74	0.62	0.60	46	27	35	16.0	39.4	55.5	59.8	68.8	64.6	62.2	--	--	--	--	--	--	--
[illegible]	Carson Sink site 2	[illegible]	1	[illegible]	[illegible]	41	[illegible]	52	52	49	39	32	29	32	42	43	40	31	0.79	0.71	0.68	34	28	21	18.3	23.2	47.4	88.1	92.9	70.8	47.7	2.8	26	16.5	1.2	24	13.6	4.4
[illegible]			2	[illegible]	[illegible]	41	[illegible]	52	52	49	39	32	29	32	42	43	40	31	0.79	0.71	0.68	34	28	21	18.3	23.2	47.4	88.1	92.9	70.8	47.7	2.8	26	16.5	1.2	24	13.6	4.0
[illegible]			3	[illegible]	[illegible]	41	[illegible]	52	52	49	39	32	29	32	42	43	40	31	0.79	0.71	0.68	34	28	21	18.3	23.2	47.4	88.1	92.9	70.8	47.7	2.8	26	16.5	1.2	24	13.6	3.4
[illegible]			4	[illegible]	[illegible]	41	45	52	52	49	39	32	29	32	42	43	40	31	0.79	0.71	0.68	34	28	21	18.3	23.2	47.4	88.1	92.9	70.8	47.7	--	--	--	--	--	--	--
[illegible]	Carson Sink site [illegible]	[illegible]	1	42	120	145	152	85	78	87	99	73	78	74	78	108	86	75	1.83	0.84	0.68	198	72	51	11.7	29.8	54.1	99.5	72.8	65.4	44.3	4.4	46	32.7	1.9	38	23.4	1.0
[illegible]			2	42	120	145	152	85	78	87	99	73	78	74	78	108	86	75	1.83	0.84	0.68	198	72	51	11.7	29.8	54.1	99.5	72.8	65.4	44.3	2.7	48	33.5	1.5	36	20.9	0.7
220			3	42	120	145	152	85	78	87	99	73	78	74	78	108	86	75	1.83	0.84	0.68	198	72	51	11.7	29.8	54.1	99.5	72.8	65.4	44.3	3.8	42	28.7	1.8	35	21.2	1.1
[illegible]			4	[illegible]	120	145	152	85	78	87	99	73	78	74	78	108	86	75	1.83	0.84	0.68	198	72	51	11.7	29.8	54.1	99.5	72.8	65.4	44.3	--	--	--	--	--	--	--
																M113 APC, Full Tracked, Test Weight 22,600 lb																						
[illegible]	Carson Sink site [illegible]	72	1	46	62	73	78	81	69	66	62	63	62	66	62	68	64	64	0.71	0.70	0.57	48	45	36	26.2	42.6	56.8	86.2	67.6	64.8	50.3	3.7	34	8.5	1.4	32	5.8	2.9
[illegible]			2	46	62	73	78	81	69	66	62	63	62	66	62	68	64	64	0.71	0.70	0.57	48	45	36	26.2	42.6	56.8	86.2	67.6	64.8	50.3	3.7	29	7.7	1.2	36	6.4	2.6
224			3	46	62	73	78	81	69	66	62	63	62	66	62	68	64	64	0.71	0.70	0.57	48	45	36	26.2	42.6	56.8	86.2	67.6	64.8	50.3	3.3	34	8.1	1.3	31	5.5	2.6
[illegible]			4	46	62	73	78	81	69	66	62	63	62	66	62	68	64	64	0.71	0.70	0.57	48	45	36	26.2	42.6	56.8	86.2	67.6	64.8	50.3	--	--	--	--	--	--	--
226	Carson Sink site 2	75	1	[illegible]	24	33	42	49	48	45	40	32	27	30	42	37	39	30	0.79	0.71	0.68	29	28	20	18.3	23.2	47.4	88.1	92.9	70.8	47.7	1.8	32	6.3	0.2	32	4.7	3.4
227			2	[illegible]	24	33	42	49	48	45	40	32	27	30	42	37	39	30	0.79	0.71	0.68	29	28	20	18.3	23.2	47.4	88.1	92.9	70.8	47.7	2.6	28	6.4	0.4	31	4.7	3.1
228			3	[illegible]	24	33	42	49	48	45	40	32	27	30	42	37	39	30	0.79	0.71	0.68	29	28	20	18.3	23.2	47.4	88.1	92.9	70.8	47.7	3.0	32	7.5	0.4	34	5.2	3.2
229			4	[illegible]	24	33	42	49	48	45	40	32	27	30	42	37	39	30	0.79	0.71	0.68	29	28	20	18.3	23.2	47.4	88.1	92.9	70.8	47.7	--	--	--	--	--	--	--
230	Carson Sink site [illegible]	77	1	17	27	35	40	38	37	35	23	26	29	29	40	33	28	28	0.76	0.80	0.64	25	22	18	20.0	25.2	32.8	52.2	89.6	82.8	68.0	3.3	25	6.3	0.0	33	4.6	4.8
231			2	17	27	35	40	38	37	35	23	26	29	29	40	33	28	28	0.76	0.80	0.64	25	22	18	20.0	25.2	32.8	52.2	89.6	82.8	68.0	3.2	26	6.7	0.9	30	5.0	4.1
232			3	17	27	35	40	38	37	35	23	26	29	29	40	33	28	28	0.76	0.80	0.64	25	22	18	20.0	25.2	32.8	52.2	89.6	82.8	68.0	2.9	26	6.4	1.2	25	4.5	4.1
233			4	17	27	[illegible]	40	38	37	35	23	26	29	29	40	33	28	28	0.76	0.80	0.64	25	22	18	20.0	25.2	32.8	52.2	89.6	82.8	68.0	--	--	--	--	--	--	--
234	Carson Sink site 5	85	1	84	108	[illegible]	142	96	82	83	76	65	65	67	81	105	75	66	1.54	0.92	0.68	162	69	45	10.4	25.4	92.0	101.6	82.8	47.8	43.8	4.0	49	4.6	2.0	34	6.8	1.6
235			2	84	108	[illegible]	142	96	82	83	76	65	65	67	81	105	75	66	1.54	0.92	0.68	162	69	45	10.4	25.4	92.0	101.6	82.8	47.8	43.8	4.3	44	4.8	2.0	38	7.6	1.3
236			3	84	108	141	142	96	82	83	76	65	65	67	81	105	75	66	1.54	0.92	0.68	162	69	45	10.4	25.4	92.0	101.6	82.8	47.8	43.8	4.6	45	3.5	0.3	41	6.6	1.2
237			4	84	108	141	142	96	82	83	76	65	65	67	81	105	75	66	1.54	0.92	0.68	162	69	45	10.4	25.4	92.0	101.6	82.8	47.8	43.8	--	--	--	--	--	--	--

(Continued)

* C indicates cohesion, psi.
φ° indicates angle of friction, deg.
S_v and S_r indicate values, in psi, for the vane head and rubber head, respectively, read from shear stress/normal stress curves at normal ground contact pressure.
a indicates soil to rubber adhesion, psi.

(1 of 3 sheets)

Table 6 (Continued)

Avg Cone Index of Layers, in. 0-6	6-12	12-18	Remolding Index of Layers, in. 0-6	6-12	12-18	Rating Cone Index of Layers, in. 0-6	6-12	12-18	Moisture Content (% Dry Wt) of Layers, in. 0-1	0-6	6-12	12-18	Dry Density (pcf) of Layers, in. 0-6	6-12	12-18	Sheargraph Vane c	Vane ϕ°	Vane S_v	Rubber a	Rubber ϕ°	Rubber S_r	Avg Rut Depth in.
2-1/2-Ton MEWA, 10x10 Truck, Test Weight 18,030 lb																						
57	57	57	0.88	0.67	0.60	50	39	34	--	--	57.6	81.2	--	65.3	52.4	3.6	28	7.2	1.1	31	5.3	0.7
57	57	57	0.88	0.67	0.60	50	39	34	--	--	57.6	81.2	--	65.3	52.4	2.0	30	5.9	1.2	31	5.4	0.7
57	57	57	0.88	0.67	0.60	50	39	34	--	--	57.6	81.2	--	65.3	52.4	2.8	28	6.4	0.7	30	4.7	0.7
57	57	57	0.88	0.67	0.60	50	39	34	--	--	57.6	81.2	--	65.3	52.4	--	--	--	--	--	--	--
44	44	35	0.79	0.71	0.68	35	31	24	18.3	23.2	47.4	88.1	92.9	70.8	47.7	3.2	26	6.5	0.2	30	4.2	1.0
44	44	35	0.79	0.71	0.68	35	31	24	18.3	23.2	47.4	88.1	92.9	70.8	47.7	1.6	32	5.9	0.5	26	3.9	0.7
44	44	35	0.79	0.72	0.68	35	31	24	18.3	23.2	47.4	88.1	92.9	70.8	47.7	1.9	32	6.1	0.2	29	4.0	0.7
44	44	35	0.79	0.71	0.68	35	31	24	18.3	23.2	47.4	88.1	92.9	70.8	47.7	--	--	--	--	--	--	--
[illegible]	28	30	0.76	0.80	0.64	24	22	19	20.0	25.2	32.8	52.2	89.6	82.8	68.0	3.0	25	6.2	0.3	31	4.5	1.2
32	[illegible]	30	0.76	0.80	0.64	24	22	19	20.0	25.2	32.8	52.2	89.6	82.8	68.0	2.6	27	6.2	0.8	30	4.8	1.0
32	26	30	0.76	0.80	0.64	24	22	19	20.0	25.2	32.8	52.2	89.6	82.8	68.0	3.4	23	6.2	1.0	28	4.6	1.0
[illegible]	[illegible]	30	[illegible]	0.80	0.64	24	22	19	20.0	25.2	32.8	52.2	89.6	82.8	68.0	--	--	--	--	--	--	--
[illegible]	[illegible]	74	2.19	1.56	0.92	210	76	66	7.3	28.6	75.4	92.4	73.4	54.4	47.6	4.2	48	11.7	[illegible]	44	6.7	0.1
[illegible]	[illegible]	74	2.19	1.56	0.92	210	76	66	7.3	28.6	75.4	92.4	73.4	54.4	47.6	5.0	43	11.3	1.6	43	7.9	0.1
[illegible]	[illegible]	74	2.19	1.56	0.92	210	76	66	7.3	28.6	75.4	92.4	73.4	54.4	47.6	5.7	46	10.8	1.2	43	7.6	0.1
[illegible]	[illegible]	74	2.19	1.56	0.92	210	76	66	7.3	28.6	75.4	92.4	73.4	54.4	47.6	--	--	--	--	--	--	--
24	29	26	0.65	0.62	0.61	19	13	17	50.2	48.9	49.5	52.0	68.8	70.3	66.6	1.7	2	1.9	1.8	2	2.0	0.5
26	30	31	0.65	0.62	0.61	17	19	19	50.2	48.9	49.5	52.0	68.8	70.3	66.6	1.6	3	2.0	1.6	3	2.0	0.5
21	24	24	0.65	0.62	0.61	14	15	15	50.2	48.9	49.5	52.0	68.8	70.3	66.6	1.6	2	1.9	1.6	4	2.1	0.5
24	27	27	0.65	0.62	0.61	16	17	16	50.2	48.9	49.5	52.0	68.8	70.3	66.6	--	--	--	--	--	--	--
2-1/2-Ton MEWA, 6x6 Track, Test Weight 19,013 lb																						
49	60	54	0.71	0.70	0.57	49	42	31	26.2	42.6	56.8	86.2	67.6	64.8	57.2	2.8	30	7.8	0.1	34	[illegible]	1.0
[illegible]	60	54	0.71	0.70	0.57	49	42	33	26.2	42.6	56.8	86.2	67.6	64.8	57.2	1.8	34	7.7	1.3	34	7.2	1.0
[illegible]	60	54	0.71	0.70	0.57	49	42	31	26.2	42.6	56.8	86.2	67.6	64.8	57.2	2.3	34	8.2	0.2	34	[illegible]	1.0
49	60	54	0.71	0.70	0.57	49	42	32	26.2	42.6	56.8	86.2	67.6	64.8	57.2	--	--	--	--	--	--	--
39	41	32	0.77	0.78	0.58	30	32	[illegible]	19.5	27.5	56.2	71.0	81.2	60.4	50.3	2.8	32	8.2	3.2	28	7.7	1.4
[illegible]	41	32	0.77	0.78	0.58	30	32	19	19.5	27.5	56.2	71.0	81.2	60.4	50.3	2.6	[illegible]	8.2	0.0	[illegible]	5.7	1.4
[illegible]	41	32	0.77	0.78	0.58	30	32	19	19.5	27.5	56.2	71.0	81.2	60.4	50.3	1.4	27	8.0	0.2	32	5.7	1.2
[illegible]	41	32	0.77	0.78	0.58	30	32	19	19.5	27.5	56.2	71.0	81.2	60.4	50.3	--	--	--	--	--	--	--
33	31	28	0.76	0.80	0.64	25	25	18	20.0	25.2	32.8	52.2	89.6	82.8	73.6	3.8	31	9.0	0.4	32	5.8	1.9
33	31	28	0.76	0.80	0.64	25	25	18	20.0	25.2	32.8	52.2	89.6	82.8	73.6	2.0	30	7.0	0.0	35	[illegible]	2.0
33	31	28	0.76	0.80	0.64	25	25	18	20.0	25.2	32.8	52.2	89.6	82.8	73.6	2.6	32	8.0	0.3	36	6.7	1.8
33	31	28	0.76	0.80	0.64	25	25	18	20.0	25.2	32.8	52.2	89.6	82.8	73.6	--	--	--	--	--	--	--
22	25	26	0.65	0.80	0.73	[illegible]	20	19	45.5	43.2	41.8	33.0	73.4	73.6	78.2	2.2	4	2.7	1.4	6	[illegible]	1.1
[illegible]	[illegible]	25	0.65	0.80	0.73	13	22	20	45.5	43.2	41.8	33.0	73.4	73.6	78.2	3.2	5	3.9	1.6	5	2.8	0.9
20	20	24	0.62	0.76	0.62	12	15	15	53.0	51.6	51.4	52.8	67.6	68.2	68.2	2.5	3	2.9	1.6	7	2.4	2.0
[illegible]	22	26	0.62	0.74	0.62	11	16	16	53.0	51.6	51.4	52.8	67.6	68.2	68.2	2.5	2	2.8	1.5	7	2.5	1.1
2-1/2-Ton MEWA Track, Test Weight 1[illegible],[illegible]80 lb																						
[illegible]	[illegible]	55	0.88	0.67	0.60	52	40	33	--	--	57.6	81.2	--	65.3	52.4	3.9	27	5.2	1.0	31	2.5	1.7
[illegible]	[illegible]	55	0.88	0.67	0.60	52	40	33	--	--	57.6	81.2	--	65.3	52.4	3.8	25	5.0	0.6	33	2.4	1.7
[illegible]	[illegible]	55	0.88	0.67	0.60	52	40	33	--	--	57.6	81.2	--	65.3	52.4	2.2	31	3.8	2.7	26	4.0	1.6
[illegible]	[illegible]	55	0.88	0.67	0.60	52	40	33	--	--	57.6	81.2	--	65.3	52.4	--	--	--	--	--	--	--
40	[illegible]	25	0.72	0.72	0.68	32	26	19	18.3	23.2	47.4	88.1	92.9	70.8	47.7	2.8	27	4.1	1.2	24	2.3	2.2
40	[illegible]	25	0.72	0.71	0.68	32	26	19	18.3	23.2	47.4	88.1	92.9	70.8	47.7	2.8	27	4.1	1.2	24	2.3	1.9
40	[illegible]	25	0.72	0.71	0.68	32	26	19	18.3	23.2	47.4	88.1	92.9	70.8	47.7	2.8	27	4.1	1.2	24	2.3	1.7
40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	32	26	19	18.3	23.2	47.4	88.1	92.9	70.8	47.7	--	--	--	--	--	--	--

(Continued)

(2 of 3 sheets)

Table c (Concluded)

Item No.	[illegible]	[illegible]	[illegible]	Cone index by depth, in.												Avg Cone Index of Layers, in.			Remolding Index of Layers, in.			Rating Cone Index of Layers in.			Moisture Content (% Dry Wt) of Layers in.				Dry Density (pcf) of Layers, in.			Sheargraph Vane			Sheargraph Rubber			Avg Rut Depth
				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0-6	6-12	12-18	0-6	6-12	12-18	0-6	6-12	12-18	0-1	0-6	6-12	12-18	0-6	6-12	12-18	c	φ°	S_v	a	φ°	S_r	in.
	2-1/2-Ton [illegible] Truck, Test Weight [illegible] lb (Continued)																																					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24	[illegible]	27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.80	0.64	24	21	17	20.0	25.2	32.8	52.2	89.6	82.8	68.0	4.0	24	5.1	0.6	28	2.0	2.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.76	0.80	0.64	24	21	17	20.0	25.2	32.8	52.2	89.6	82.8	68.0	4.0	24	5.8	0.6	28	2.0	2.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24	[illegible]	27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.80	0.64	24	21	17	20.0	25.2	32.8	52.2	89.6	82.8	68.0	4.0	24	5.8	[illegible]	28	2.0	2.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24	[illegible]	27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.80	0.64	24	21	17	20.0	25.2	32.8	52.2	89.6	82.8	68.0	--	--	--	--	--	--	--
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible]	69	1.54	0.92	[illegible]	154	77	47	10.4	25.4	92.0	101.6	82.8	47.8	43.8	4.7	41	7.0	1.2	39	3.4	0.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible]	70	72	[illegible]	100	[illegible]	[illegible]	1.54	[illegible]	0.68	154	77	47	10.4	25.4	92.0	101.6	82.8	47.8	43.8	4.0	42	6.4	1.7	39	3.8	0.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible]	70	72	[illegible]	100	[illegible]	[illegible]	1.54	0.92	0.68	154	77	47	10.4	25.4	92.0	101.6	92.8	47.8	45.8	2.6	46	5.7	1.3	42	3.6	0.7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible]	70	72	[illegible]	100	94	69	1.54	[illegible]	0.68	154	77	47	10.4	25.4	92.0	101.6	82.8	47.8	43.8	--	--	--	--	--	--	--
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	27	[illegible]	[illegible]	[illegible]	--	25	25	27	0.62	0.74	0.70	17	21	19	46.3	44.6	43.2	42.8	71.5	72.8	73.4	3.4	4	3.5	2.2	4	2.3	1.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24	27	42	[illegible]	[illegible]	24	27	30	0.62	0.74	0.70	15	20	21	46.3	44.6	43.2	42.8	71.5	72.8	73.4	3.4	4	3.5	2.2	4	2.3	2.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25	[illegible]	[illegible]	24	23	25	0.65	0.62	0.61	16	14	15	50.2	48.9	49.5	52.0	68.8	70.3	66.6	--	--	--	--	--	--	--
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22	[illegible]	[illegible]	[illegible]	17	21	0.52	0.56	0.64	7	10	13	68.8	53.6	53.8	49.2	64.5	72.0	67.8	1.0	4	1.2	1.4	5	1.5	3.6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	22	[illegible]	11	16	21	0.52	0.56	0.64	6	9	13	68.8	58.6	53.8	49.2	64.5	72.0	67.8	--	--	--	--	--	--	--

(3 of 3 sheets)

Table 7

Summary of Vehicle Performance Data, Maneuver Test Results

Item No.	Test No.	Range and Transmission	Turn No.	Steering Angle deg	Force Computed from Torque* lb	Avg Speed for Turn mph	Measured Turning Radius ft
Military Vehicles							
XM410E1							
[illegible]	[illegible]	Low, 1st	1	[illegible]	[illegible]	[illegible]	
				2.6	[illegible]		
				[illegible]	[illegible]		[illegible]
[illegible]		Low, 1st	[illegible]	[illegible]	[illegible]	[illegible]	
				[illegible]	[illegible]		[illegible]
[illegible]		Low, [illegible]	[illegible]	[illegible]	[illegible]	11.1[illegible]	
				[illegible]	[illegible]		[illegible]
[illegible]		Low, 1st	[illegible]	--	--	[illegible]**	[illegible]
[illegible]	[illegible]	Low, 1st	1	[illegible]	[illegible]	[illegible]	
				[illegible]	[illegible]		36
[illegible]		Low, 1st	[illegible]	[illegible]	[illegible]	[illegible]	
				[illegible]	[illegible]		[illegible]
Military Vehicles (Continued)							
XM410E1 (Continued)							
200	61	Low, 2d	3	0	1477	11.60	
				4.0	1216		
				9.3	1476		
				17.9	1129		
				25.5	1216		
				29.0	2171		
				29.5	2779		46
201		Low, 1st	4	--	--	1.00**	32
202	[illegible]	Low, 1st	1	0	2742	5.42	
				4.1	2610		
				9.3	2693		
				17.6	2785		
				26.7	2959		
				29.1	3041		
				30.1	3389		
				30.5	3572		39
203		Low, 1st	2	0	2786	7.50	
				2.1	2785		
				9.5	2867		
				17.6	2959		
				27.9	3307		
				30.1	3737		
				30.5	4003		41
204		Low, 2d	3	0	3030	10.32	
				2.1	2959		
				9.3	3041		
				17.4	2959		
				27.4	3133		
				29.6	3481		42
205		Low, 1st	4	--	--	1.00**	32
206	[illegible]	Low, 1st	1	0	844	5.61	
				3.5	953		
				8.2	1044		
				15.9	1127		
				23.9	1218		
				29.2	1649		
				30.1	1649		
				30.1	1566		37
Military Vehicles (Continued)							
XM410E1 (Continued)							
207	69	Low, 1st	2	0	[illegible]32	8.53	
				2.0	[illegible]		
				8.5	870		
				15.9	1127		
				25.4	1301		
				26.6	1475		
				27.7	1649		
				28.1	1392		41
208		Low, 2d	3	0	[illegible]32	8.76	
				3.5	522		
				7.6	[illegible]04		
				14.5	779		
				22.9	870		
				26.2	1049		43
209		Low, 1st	4	--	--	1.00**	35
M35A2 (mod)							
210	48	Low, 1st	1	0	2[illegible]8	3.71	
				2.5	2153		
				8.0	1981		
				10.[illegible]	2324		
				15.1	2582		
				19.2	2496		
				22.8	2410		
				25.2	3533		36
211		Low, 2d	2	0	2582	[illegible].13	
				3.3	2582		
				[illegible].7	2668		
				11.5	2839		
				1[illegible].5	3097		
				20.5	3276		
				21.2	3533		
				23.2	3791		38
212		Low, 3d	3	0	3011	9.52	
				3.5	2925		
				7.7	2925		
				11.5	2925		
				15.1	3302		
				18.7	2839		
				23.5	4048		39
213		Low, 1st	4	--	--	1.00**	31

(Continued)

* Performance in terms of force (at the wheel- or track-ground interface) was computed from drive-line torque divided by vehicle weight without regard to efficiency losses between torque sensor and wheel- or track-ground interface.

** Approximate value.

(1 of 4 sheets)

Table 7 (Continued)

Item No.	Test No.	Range and Transmission	Turn No.	Steering Angle deg	Force Computed from Torque lb	Avg Speed for Turn mph	Measured Turning Radius ft
				Military Vehicles (Continued)			
				[illegible] (mod) (Continued)			
[illegible]	[illegible]	Low, [illegible]	[illegible]	0	[illegible]	[illegible]	
				[illegible]	[illegible]		
				[illegible]	[illegible]		
				[illegible]	[illegible]		
				[illegible]	[illegible]		
				[illegible]	[illegible]		
				[illegible]	[illegible]		
				[illegible]	[illegible]		[illegible]
[illegible]		Low, [illegible]	[illegible]	0	[illegible]	[illegible]	
				2.7	[illegible]		
				[illegible]	[illegible]		
				11.[illegible]	[illegible]		
				[illegible]	[illegible]		
				19.7	[illegible]		
				21.8	4321		
				24.7	[illegible]		38
216		Low, [illegible]	[illegible]	0	3097	[illegible]	
				[illegible]	3175		
				[illegible]	3245		
				11.[illegible]	3175		
				[illegible]	[illegible]		
				[illegible]	3744		
				[illegible]	[illegible]		
				25.2	[illegible]		[illegible]
217		Low, 1st	4	--	--	1.00**	32
218	[illegible]	Low, 1st	1	0	991	3.38	
				2.3	913		
				6.0	741		
				11.2	827		
				15.6	1240		
				18.0	1404		
				21.6	1451		
				24.5	1654		32
219		Low, 2d	2	0	1076	7.61	
				3.8	827		
				7.8	1076		
				10.8	1240		
				14.3	1404		
				18.2	1568		
				23.0	1903		
				25.2	1903		35
				Military Vehicles (Continued)			
				M35A2 (mod) (Continued)			
220	[illegible]	Low, 2d	3	0	1076	11.08	
				3.8	1076		
				7.8	1240		
				10.3	1404		
				19.8	1903		
				24.7	2644		41
221		Low, 1st	4	--	--	1.00**	34
				M113			
222	73	1-2	1			1.63	24
223		1-2	2			6.53	24
224		3-4	3			9.38	22
225		1-2	4			1.00**	17
226	75	1-2	1			1.73	21
227		1-2	2			5.53	24
228		3-4	3			4.47	24
229		1-2	4			1.00**	19
230	77	1-2	1			1.28	24
231		1-2	2			3.35	24
232		1-2	3			5.09	25
233		1-2	4			1.00**	21
234	85	1-2	1			1.83	20
235		1-2	2			7.87	22
236		1-2	3			11.03	22
237		1-2	4			1.00**	17
				MEXA Vehicles			
				MEXA 10x10			
238	26	Low, 1st	1	0	1224	3.71	
				3.1	1355		
				6.1	1248		
				9.5	1531		
				12.4	1814		
				15.7	1862		
				22.0	2067		
				25.1	2808		42
239		Low, 2d	2	0	1722	8.83	
				2.7	1833		
				5.5	1609		
				8.8	1745		
				12.8	1882		
				17.6	2164		
				24.3	2379		
				25.2	3062		44
				MEXA Vehicles (Continued)			
				MEXA 10x10 (Continued)			
240	26	High, 1st	3	0	1822	13.32	
				2.2	2018		
				6.1	1930		
				10.7	2213		
				15.2	1989		
				19.6	2018		
				24.2	2106		
				24.9	2935		48
241		Low, 1st	4	--	--	1.00**	37
242	29	Low, 1st	1	0	2120	3.74	
				1.1	1882		
				6.3	2018		
				10.6	2204		
				16.0	2349		
				20.2	2837		
				25.6	3149		
				25.6	3949		43
243		Low, 2d	2	0	2000	8.11	
				0.8	2184		
				4.6	1959		
				10.4	2145		
				16.0	2125		
				21.8	2291		
				26.2	2583		
				26.7	3374		45
244		High, 1st	3	0	2560	[illegible]	
				5.4	2525		
				10.2	2583		
				14.6	2603		
				20.0	2671		
				24.3	2798		
				24.3	3559		48
245		Low, 1st	4	--	--	1.00**	38
246	32	Low, 1st	1	0	1551	3.77	
				5.3	1618		
				14.0	2106		
				22.6	2564		
				26.0	3559		45
247		Low, 2d	2	0	1827	7.79	
				1.1	1960		
				6.7	1852		
				14.8	1989		
				24.6	2623		
				26.0	3422		46

(Continued)

** Approximate value.

(2 of 4 sheets)

Table 7 (Continued)

Item No.	Test No.	Range and Trans-mission	Turn No.	Steering Angle deg	Force Com-puted from Torque lb	Avg Speed for Turn mph	Measured Turning Radius ft
				MEXA Vehicles (Continued)			
				MEXA 10x10 (Continued)			
[illegible]	42	High, 1st	1	0	2060	12.30	
				[illegible]	1440		
				[illegible]	1540		
				1[illegible].1	[illegible]		
				[illegible].7	[illegible]		
				[illegible]	[illegible]		47
[illegible]		Low, 1st	4	--	--	1.00**	[illegible]
[illegible]	[illegible]	Low, 1st	1	0	[illegible]	[illegible].81	
				[illegible]	[illegible]		
				[illegible]	790		
				[illegible]	[illegible]		
				1[illegible].7	851		
				1[illegible]	1135		
				[illegible]	1707		
				[illegible]	2093		37
[illegible]		Low, 2d	2	0	400	7.[illegible]	
				3.1	371		
				[illegible]	288		
				10.1	295		
				14.1	[illegible]		
				15.4	414		
				[illegible]	[illegible]		
				[illegible]	1489		[illegible]
[illegible]		High, 1st	1	[illegible]	1480	[illegible].09	
				[illegible].7	1780		
				[illegible]	11[illegible]		
				[illegible]	977		
				[illegible].7	6[illegible]7		
				[illegible]	101[illegible]		
				[illegible]	10[illegible]		
				[illegible]	[illegible]		39
[illegible]		Low, 1st	4	--	--	1.00**	[illegible]
[illegible]	[illegible]	Low, 1st	1	0	[illegible]	[illegible]	
				[illegible]	[illegible]		
				[illegible]	[illegible]		
				11.[illegible]	[illegible]		
				1[illegible]	[illegible]		
				[illegible].1	[illegible]		
				[illegible]	1[illegible]		
				[illegible]	1[illegible]		[illegible]
				MEXA Vehicles (Continued)			
				MEXA 10x10 (Continued)			
255	121	Low, 2d	2	0	1394	7.09	
				2.8	1417		
				8.7	1287		
				12.8	1309		
				17.5	1274		
				22.0	1294		
				27.0	1400		
				27.0	1420		45
256		Low, 1st	3	0	1132	4.58	
				6.5	1105		
				13.3	1225		
				20.2	1277		
				27.5	1561		
				27.6	1792		39
257		Low, 1st	4	--	--	1.00**	36
				MEXA 8x8			
258	99	Low, 2d	1			2.90	37
259		Low, 1st	2			4.50	40
260		Low, 1st	3			7.69	40
261		Low, 1st	4			1.00**	32
262	100	Low, 1st	1			2.97	36
263		Low, 1st	2			4.46	37
264		Low, 2d	3			7.19	38
265		Low, 1st	4			1.00**	30
266	102	Low, 1st	1			3.23	36
267		Low, 1st	2			4.42	36
268		Low, 2d	3			7.27	29
269		Low, 1st	4			1.00**	31
270	149	Low, 1st	1			7.50	34
271		Low, 2d	2			4.40	32
272	158	Low, 2d	1			5.20	34
273		Low, 1st	2			2.70	32
				MEXA Vehicles (Continued)			
				MEXA Track			
274	37	Low, 1st	1	0	1630	2.80	
				3.4	2447		
				10.4	2972		
				17.7	3490		
				25.2	4539		
				27.2	4592		
				27.2	5534		35
275		High, 1st	2	0	1990	5.29	
				0.6	1807		
				2.2	1803		
				9.8	2668		
				18.2	3779		
				26.0	4073		
				27.5	4117		
				27.5	5620		41
276		High, 2d	3	0	2090	7.92	
				3.4	2427		
				11.4	3347		
				19.8	3392		
				27.7	3384		
				27.7	3376		41
277		Low, 1st	4	--	--	1.00**	34
278	40	Low, 1st	1	0	2056	3.19	
				7.9	2943		
				15.3	3888		
				22.7	4601		
				27.1	4941		
				27.2	5920		36
279		Low, 2d	2	0	2514	5.45	
				7.0	2784		
				14.8	3720		
				22.9	4816		
				27.0	4394		
				27.0	5408		38
280		High, 1st	3	0	2307	6.27	
				7.0	3092		
				15.0	3437		
				23.2	3814		
				27.0	3586		
				27.0	3576		39
281		Low, 1st	4	--	--	1.00**	33

(Continued)

** Approximate value.

(3 of 4 sheets)

Table 7 (Concluded)

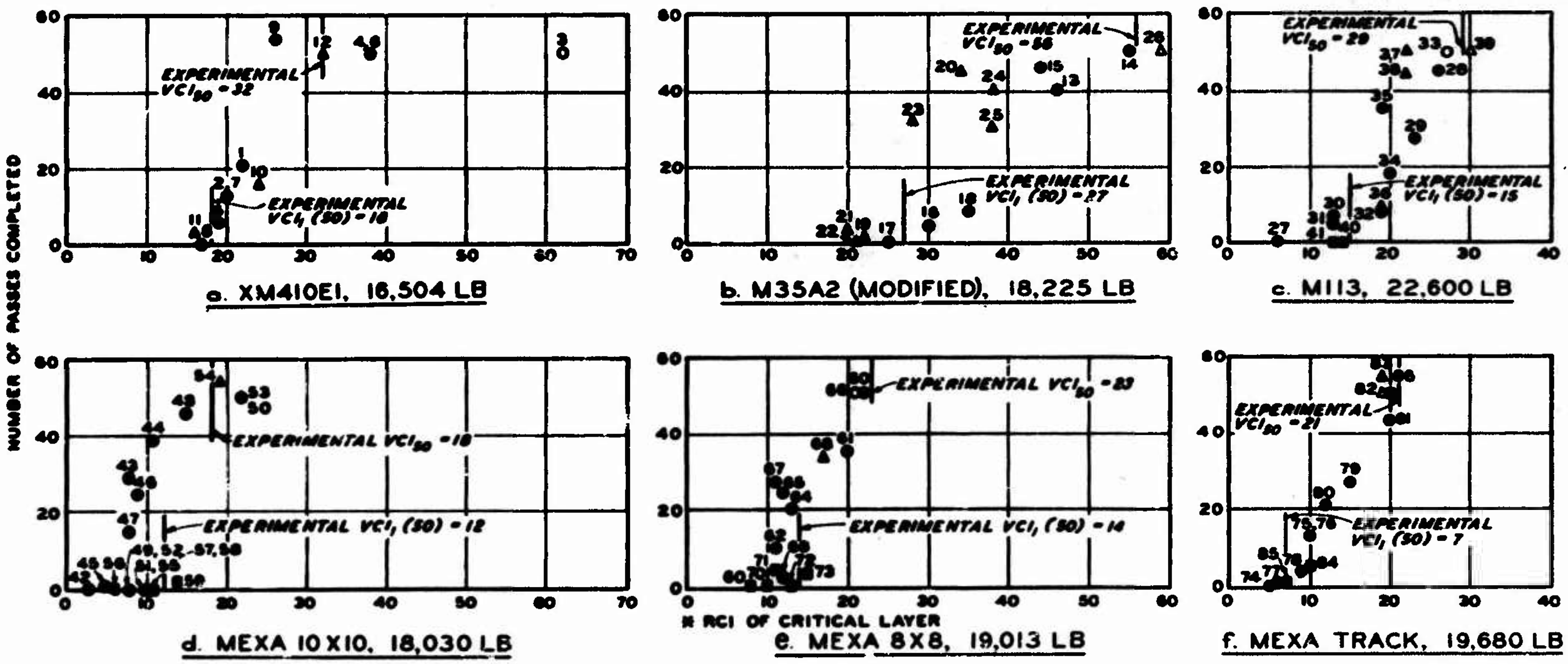
Item No.	Test No.	Range and Transmission	Turn No.	Steering Angle deg	Force Computed from Torque lb	Avg Speed for Turn mph	Measured Turning Radius ft
		MFXA Vehicles (Continued)					
		MFXA Track (Continued)					
[illegible]	[illegible]	Low, 1st	1	0	[illegible]	[illegible]	
				[illegible]	[illegible]		
				[illegible]	3211		
				[illegible]	[illegible]		
				[illegible]	4211		
				[illegible]	[illegible]		
				[illegible]	5002		
				[illegible]	[illegible]		
				[illegible]	[illegible]		
				[illegible]	[illegible]		40
[illegible]		Low, 2d	2	0	[illegible]	[illegible]	
				1.4	[illegible]		
				[illegible]	[illegible]		
				7.0	[illegible]		
				10.7	[illegible]		
				14.0	4319		
				19.1	4249		
				23.1	4297		
				25.9	4416		
				25.9	4424		42
284		High, 1st	3	0	3050	6.10	
				0.7	3121		
				4.3	3492		
				8.2	4054		
				12.3	4098		
				[illegible]	4304		
				20.4	4227		
				23.8	4270		
				26.6	4520		
				26.6	[illegible]		42
285		Low, 1st	4	--	--	1.00**	35

Item No.	Test No.	Range and Transmission	Turn No.	Steering Angle deg	Force Computed from Torque lb	Avg Speed for Turn mph	Measured Turning Radius ft
		MFXA Vehicles (Continued)					
		MFXA Track (Continued)					
286	89	Low, 1st	1	0	1700	2.98	
				1.4	1167		
				4.7	2089		
				8.2	2716		
				11.8	3313		
				15.2	3526		
				18.8	3970		
				22.6	4164		
				26.1	4357		
				26.1	5360		38
287		Low, 2d	2	0	1800	5.08	
				1.4	1867		
				5.0	2321		
				8.8	3040		
				12.4	3121		
				16.3	3667		
				20.1	3535		
				24.0	3830		
				26.7	3738		
				26.7	5066		40
288		High, 1st	3	0	1870	9.95	
				0.6	1908		
				3.2	2130		
				6.9	2635		
				10.9	2737		
				14.8	2819		
				18.8	2718		
				22.8	2840		
				26.7	2981		
				26.7	3013		41
289		Low, 1st	4	--	--	1.00**	36

Item No.	Test No.	Range and Transmission	Turn No.	Steering Angle deg	Force Computed from Torque lb	Avg Speed for Turn mph	Measured Turning Radius ft
		[illegible] Vehicles (Continued)					
		[illegible] Track (Continued)					
290	131	Low, 2d	1	0	7,823	3.31	
				0.9	8,126		
				6.2	8,309		
				11.5	8,486		
				16.7	8,459		
				21.9	8,813		
				28.4	9,130		
				29.0	9,981		42
291		Low, 1st	2	0	8,031	2.85	
				6.0	8,203		
				13.4	8,348		
				20.1	8,540		
				27.7	9,510		
				28.3	11,751		41
292		Low, 1st	3	--	--	1.00**	37
293	135	Low, 1st	1	0	8,301	2.84	
				6.8	8,675		
				13.5	8,942		
				20.4	9,107		
				28.3	9,475		
				28.9	10,462		40
294		Low, 1st	2	--	--	1.00**	37

** Approximate value.

(4 of 4 sheets)

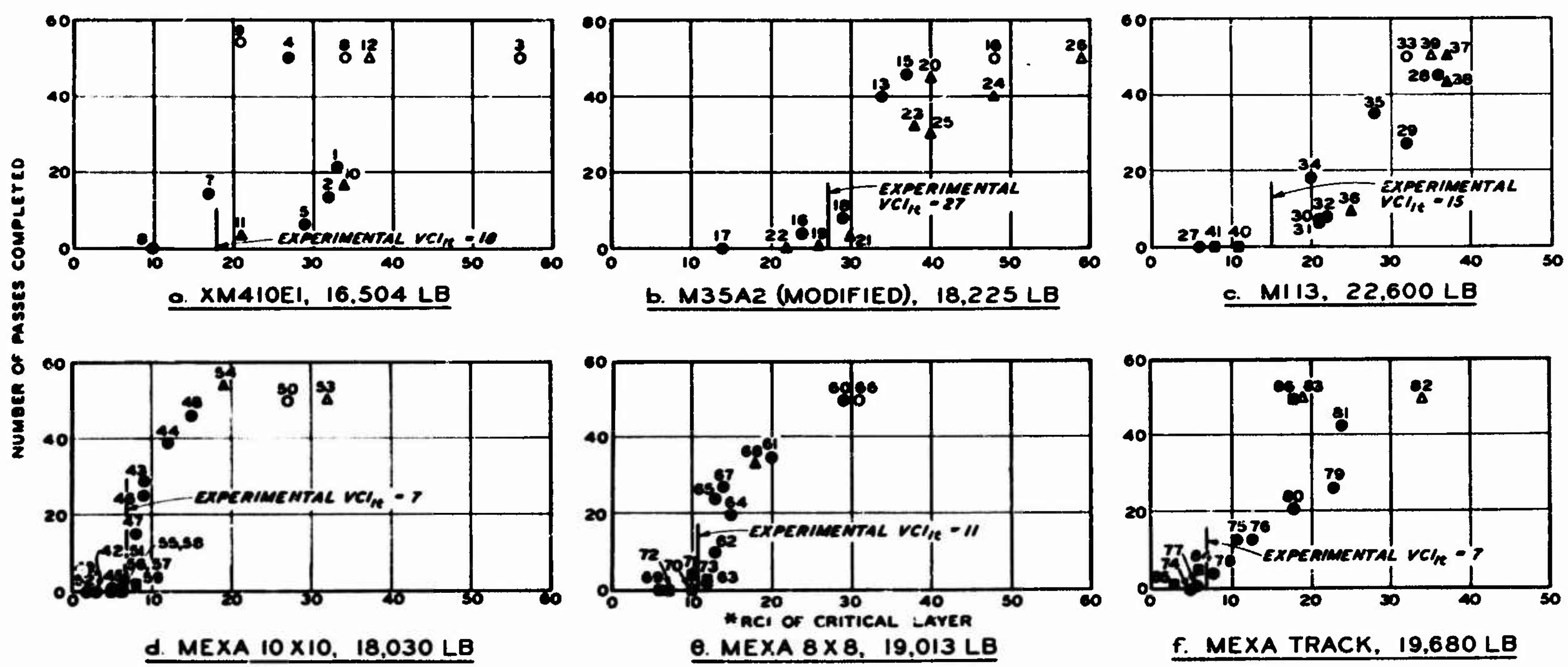


LEGEND

- O VICKSBURG TESTS
- ▲ CARSON SINK TESTS
- ◘ FOUR MILE FLAT TESTS

NOTE: NUMBERS NEAR PLOTTED POINTS ARE ITEM NUMBERS.
OPEN SYMBOLS INDICATE VEHICLE DID NOT BECOME IMMOBILIZED.
CLOSED SYMBOLS INDICATE IMMOBILIZATION OCCURRED.
+ IN OPEN SYMBOLS INDICATES DIFFICULT "GO"
* 6- TO 12-IN.- OR 12- TO 18-IN.-RCI CRITERIA.

EXPERIMENTAL VCI
50-PASS CRITERIA

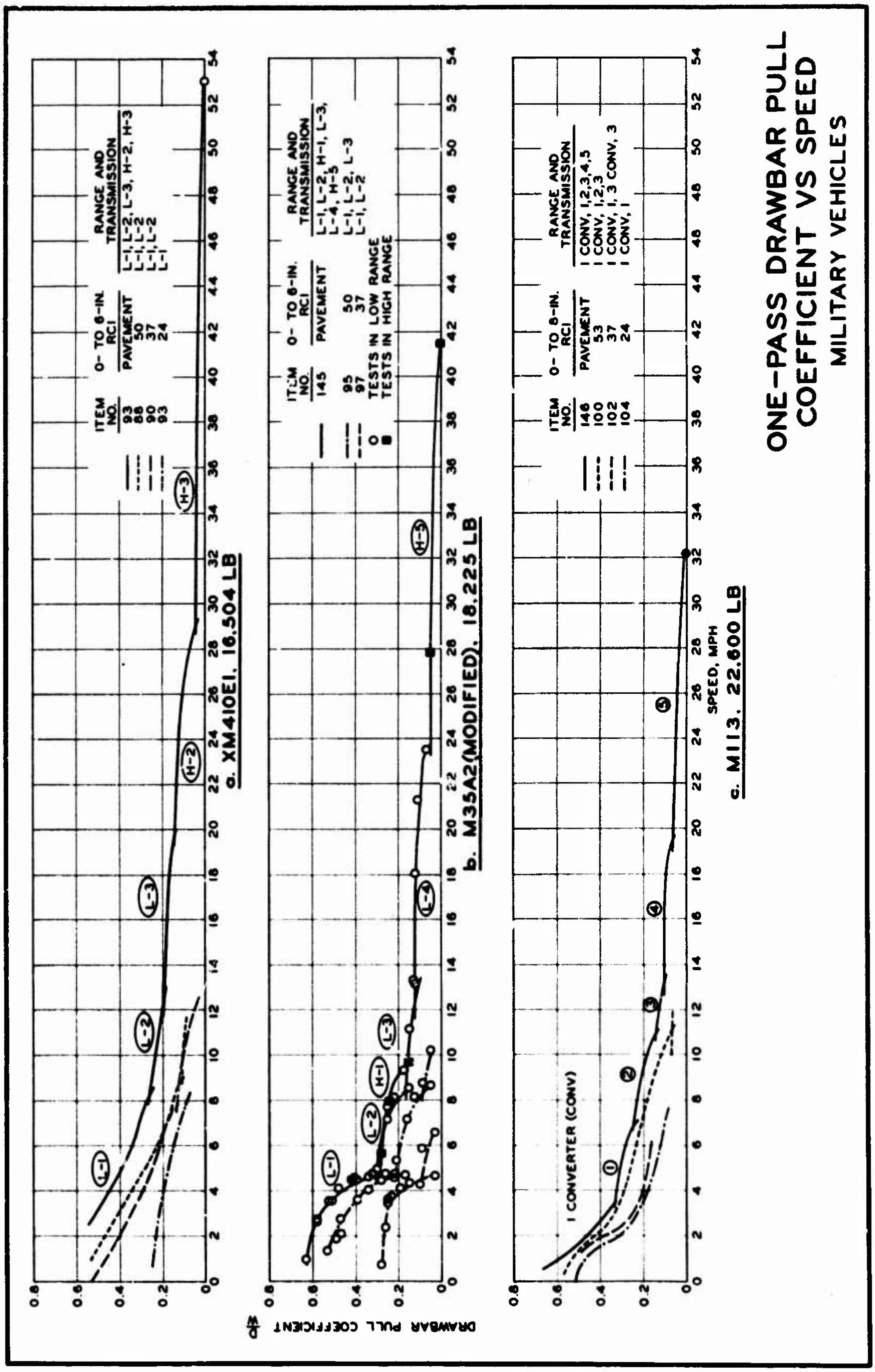


LEGEND

- O VICKSBURG TESTS
- Δ CARSON SINK TESTS
- □ FOUR MILE FLAT TESTS

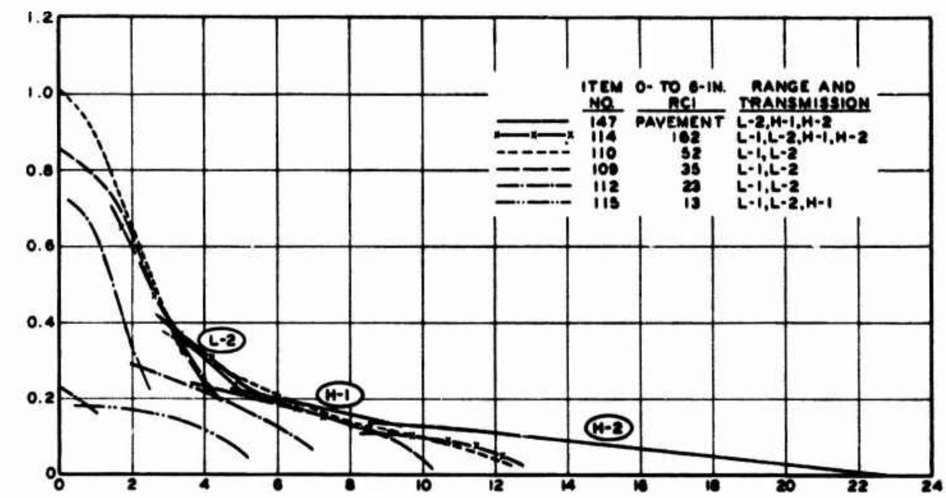
NOTE: NUMBERS NEAR PLOTTED POINTS ARE ITEM NUMBERS.
OPEN SYMBOLS INDICATE VEHICLE DID NOT BECOME IMMOBILIZED.
CLOSED SYMBOLS INDICATE IMMOBILIZATION OCCURRED.
+ IN OPEN SYMBOLS INDICATES DIFFICULT "GO."
* 0- TO 6-IN.- OR 6- TO 12-IN.-RCI CRITERIA.

EXPERIMENTAL VCI
ONE-PASS CRITERIA

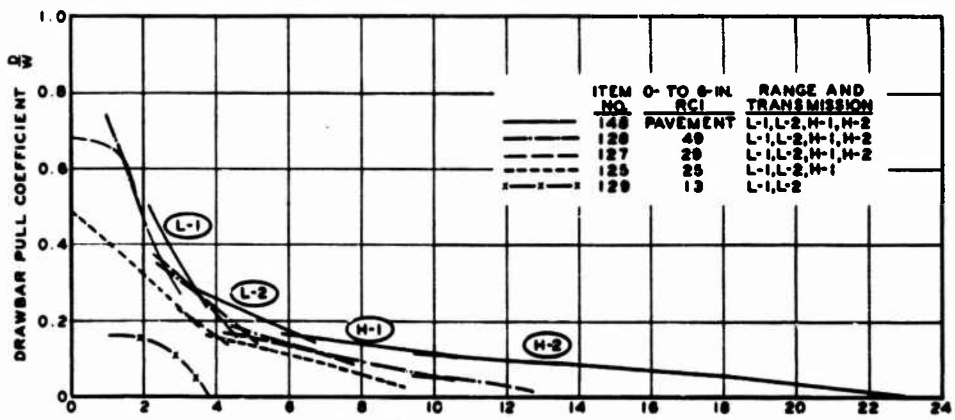


ONE-PASS DRAWBAR PULL COEFFICIENT VS SPEED
MILITARY VEHICLES
a. XM410E1, 16,504 LB
b. M35A2(MODIFIED), 18,225 LB
c. M113, 22,600 LB
DRAWBAR PULL COEFFICIENT $\frac{P}{W}$
SPEED, MPH
ITEM NO.
0- TO 6-IN. RCI
RANGE AND TRANSMISSION
93 PAVEMENT L-1, L-2, L-3, H-2, H-3
88 50 L-1, L-2
90 37 L-1, L-2
93 24 L-1
145 PAVEMENT L-1, L-2, H-1, L-3, L-4, H-5
95 50 L-1, L-2, L-3
97 37 L-1, L-2
TESTS IN LOW RANGE
TESTS IN HIGH RANGE
146 PAVEMENT 1 CONV, 1,2,3,4,5
100 53 1 CONV, 1,2,3
102 37 1 CONV, 1,3 CONV, 3
104 24 1 CONV, 1
1 CONVERTER (CONV)

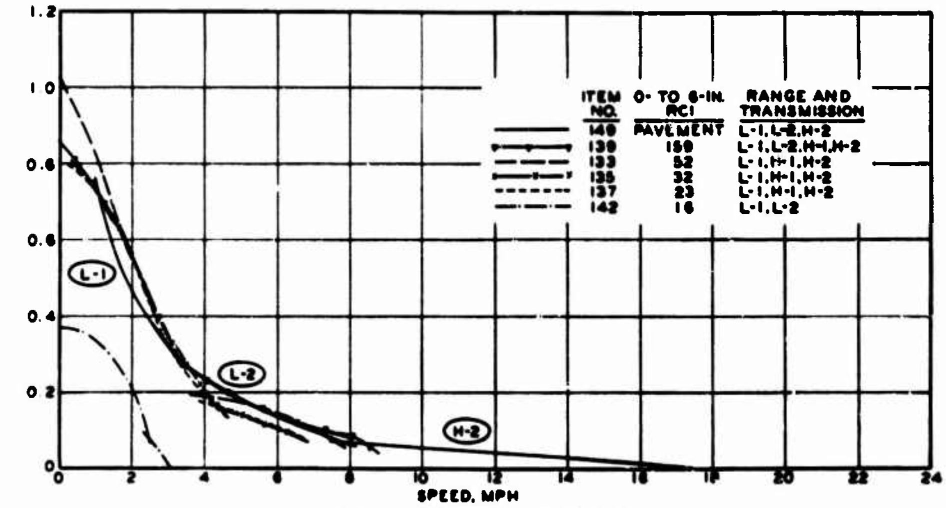
PLATE 3



a. MEXA 10X10, 18,030 LB



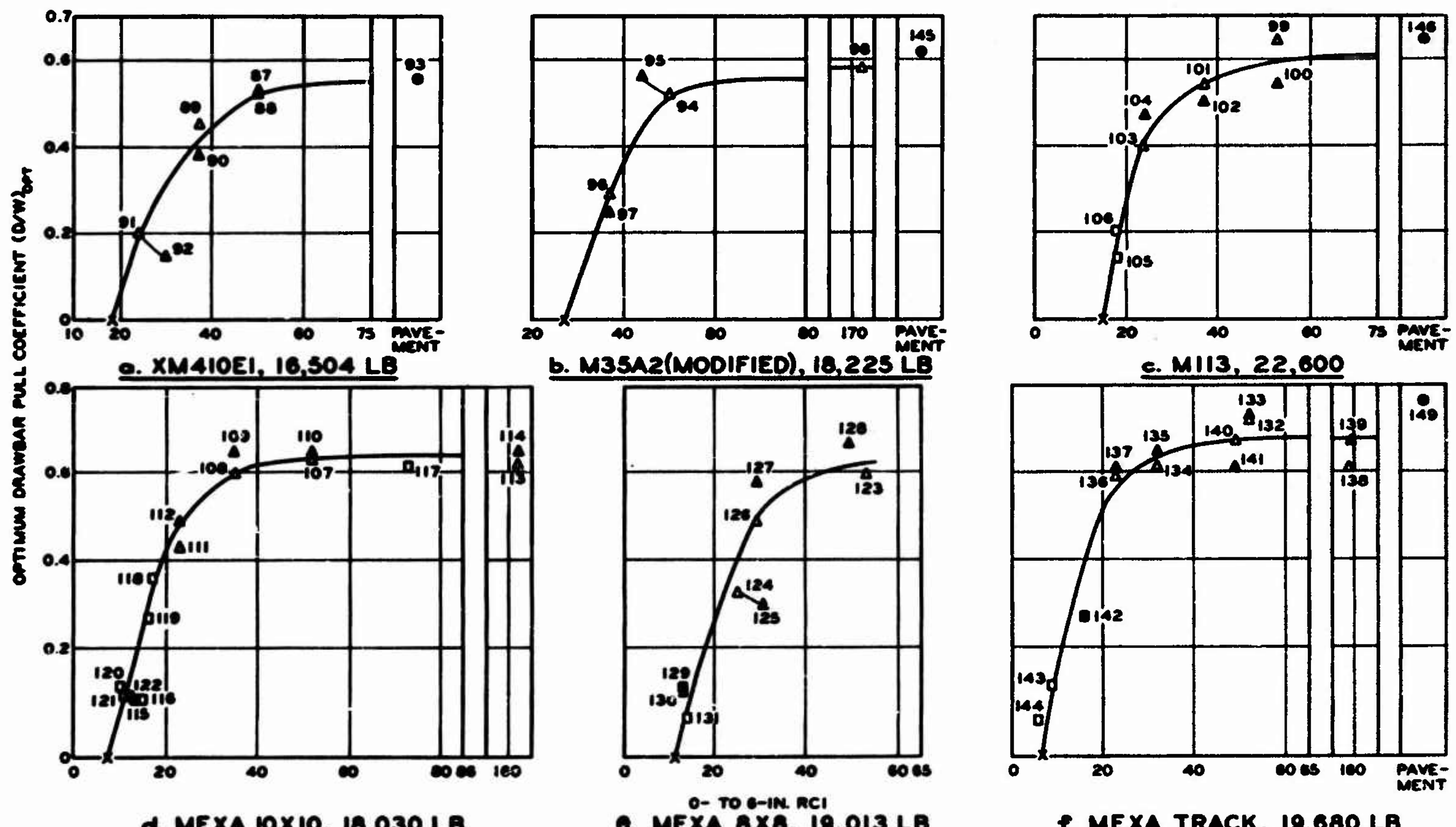
b. MEXA 8X8, 19,013 LB



c. MEXA TRACK, 19,680 LB

ONE-PASS DRAWBAR PULL COEFFICIENT VS SPEED

MEXA VEHICLES

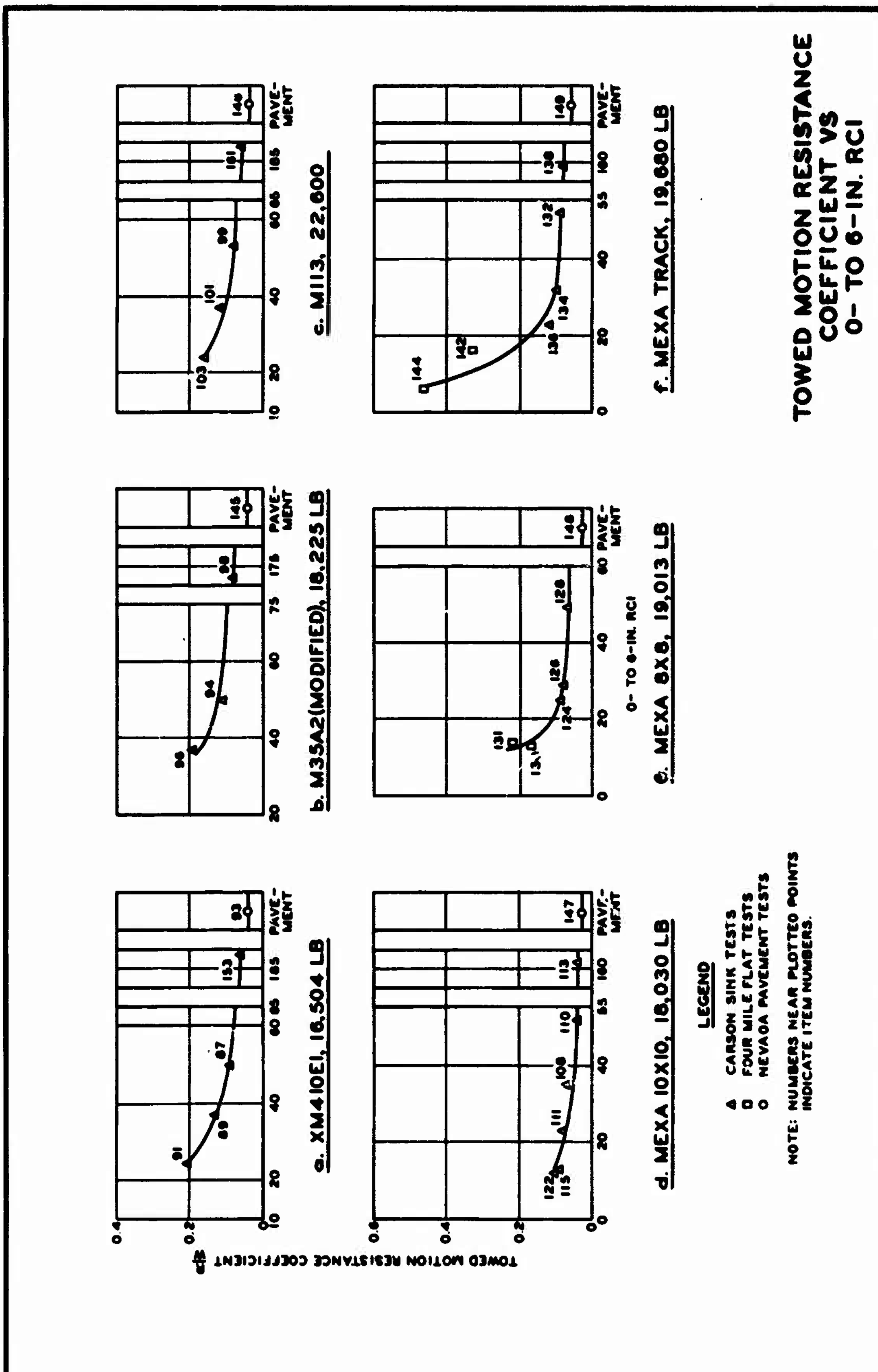


LEGEND

- △ CARSON SINK TESTS
- □ FOUR MILE FLAT TESTS
- ○ NEVADA PAVEMENT TESTS
- × VCI_R

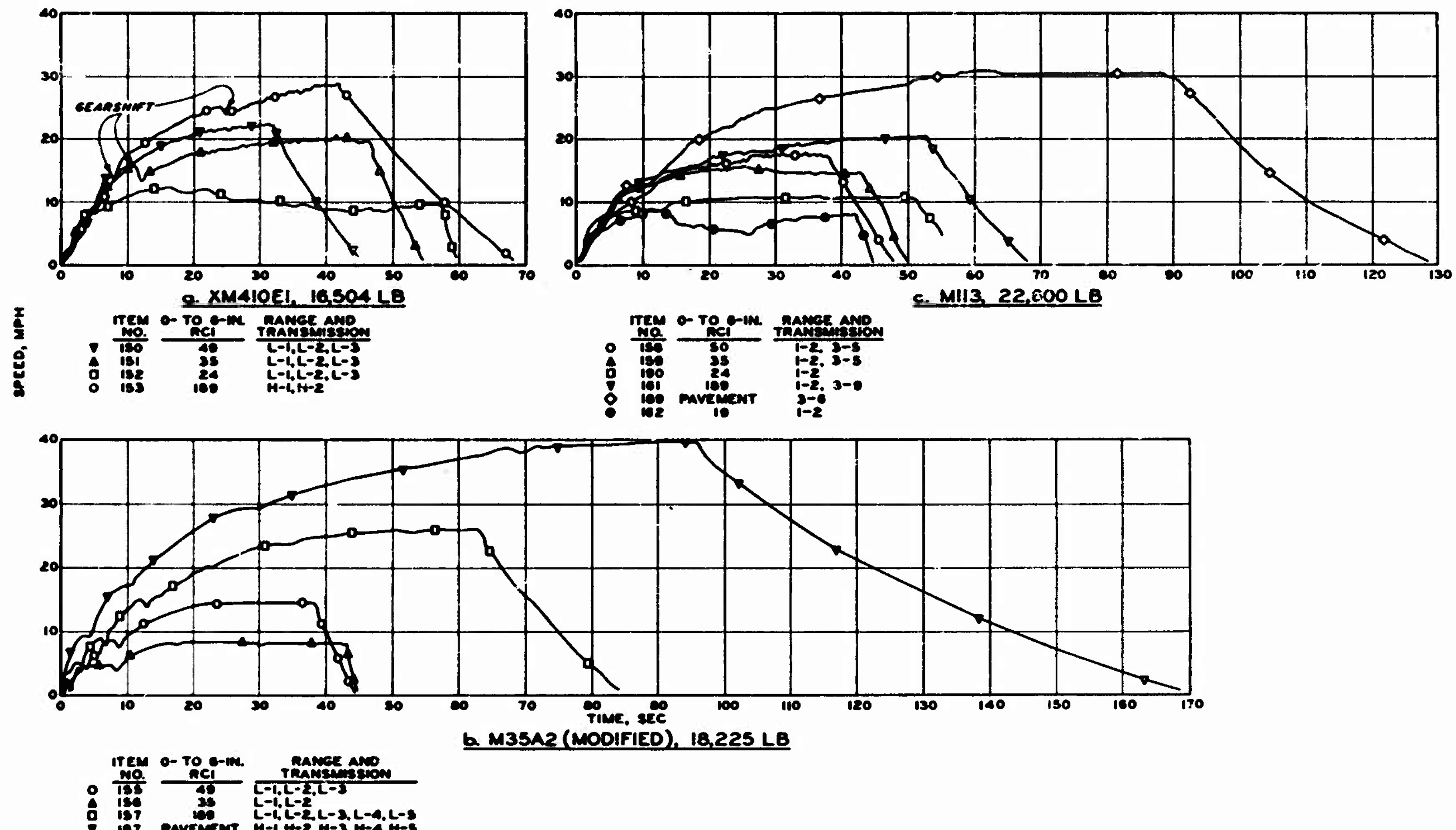
NOTE: OPEN SYMBOLS INDICATE DATA FROM DRAWBAR PULL-SLIP TESTS.
CLOSED SYMBOLS INDICATE DATA FROM DRAWBAR PULL-SPEED TESTS.
NUMBERS NEAR PLOTTED POINTS INDICATE ITEM NUMBERS.

OPTIMUM DRAWBAR PULL COEFFICIENT VS 0- TO 6-IN. RCI

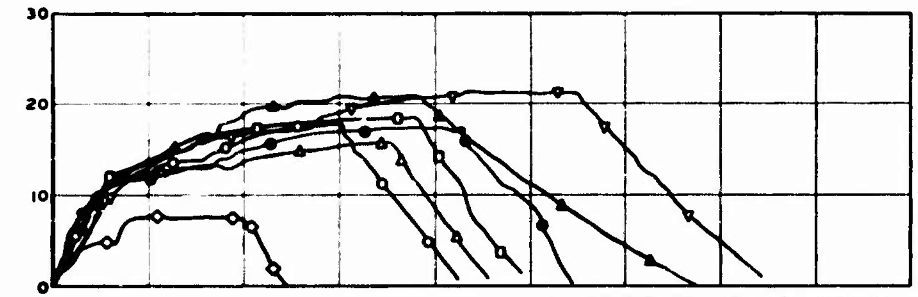


TOWED MOTION RESISTANCE COEFFICIENT VS 0- TO 6-IN. RCI
a. XM410E1, 16,504 LB
b. M35A2(MODIFIED), 18,225 LB
c. M113, 22,600
d. MEXA 10X10, 18,030 LB
e. MEXA 8X8, 19,013 LB
f. MEXA TRACK, 19,680 LB
TOWED MOTION RESISTANCE COEFFICIENT
0- TO 6-IN. RCI
PAVE-MENT
LEGEND
CARSON SINK TESTS
FOUR MILE FLAT TESTS
NEVADA PAVEMENT TESTS
NOTE: NUMBERS NEAR PLOTTED POINTS INDICATE ITEM NUMBERS.

PLATE 6

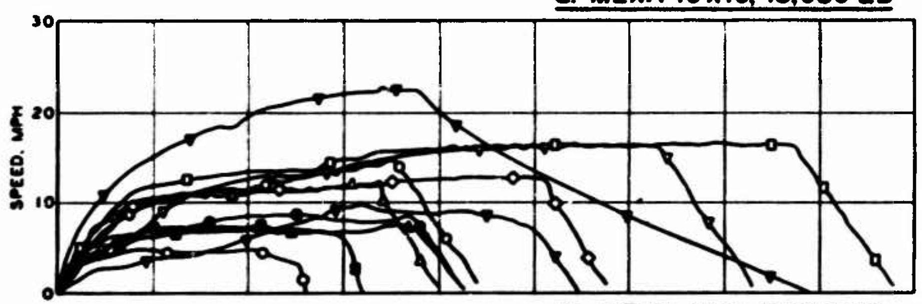


VEHICLE SPEED VS TIME
MILITARY VEHICLES



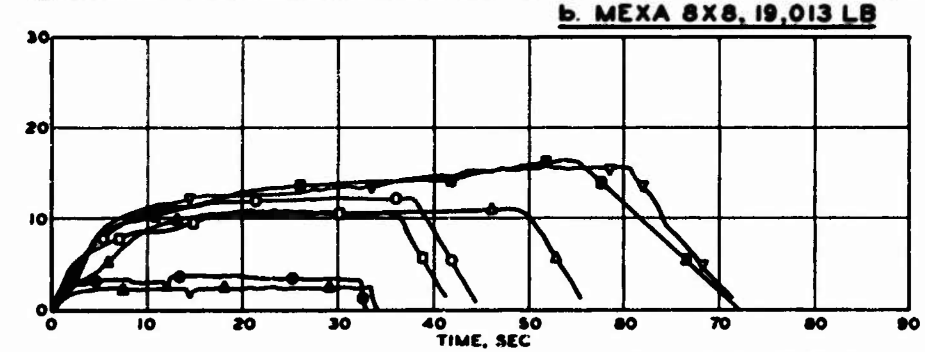
a. MEXA 10X10, 18,030 LB

SYMBOL	ITEM NO.	0- TO 6-IN. RCI	RANGE AND TRANSMISSION
○	163	35	H-1, H-2
△	164	20	H-1, H-2
□	165	52	H-1, H-2
▽	166	174	H-1, H-2
◇	167	11	L-1, L-2
●	168	69	H-1, H-2
▲	190	PAVEMENT	H-1, H-2



b. MEXA 8X8, 19,013 LB

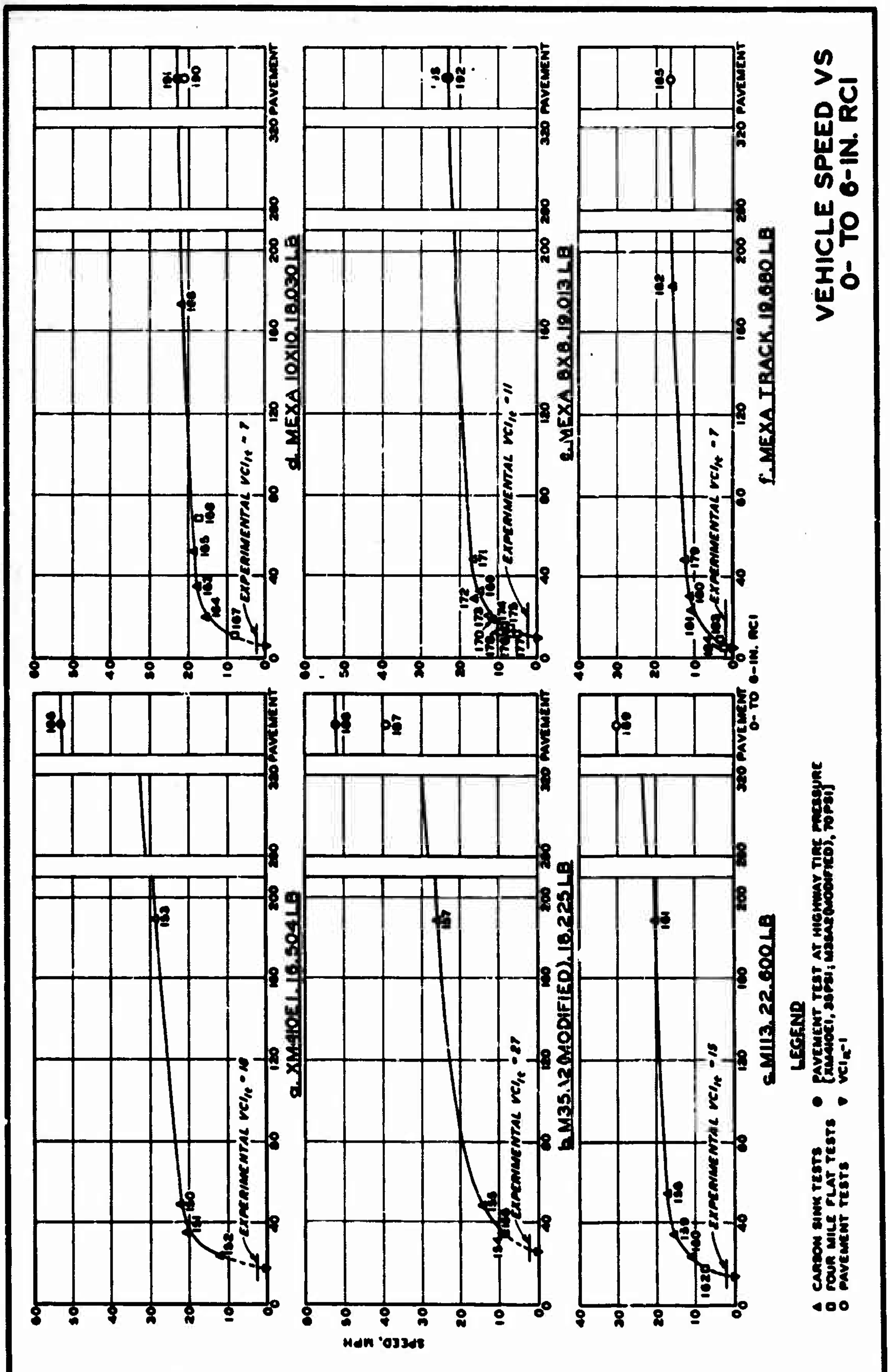
SYMBOL	ITEM NO.	0- TO 6-IN. RCI	RANGE AND TRANSMISSION
○	169	33	H-1, H-2
△	170	19	H-1, H-2
□	171	49	H-1, H-2
▽	172	29	H-1, H-2
◇	173	21	H-1, H-2
●	174	16	L-1, L-2
▲	175	15	L-1, L-2
■	176	12	L-1, L-2
○	177	12	H-1, H-2
▼	178	13	H-1, H-2
◆	192	PAVEMENT	H-1, H-2

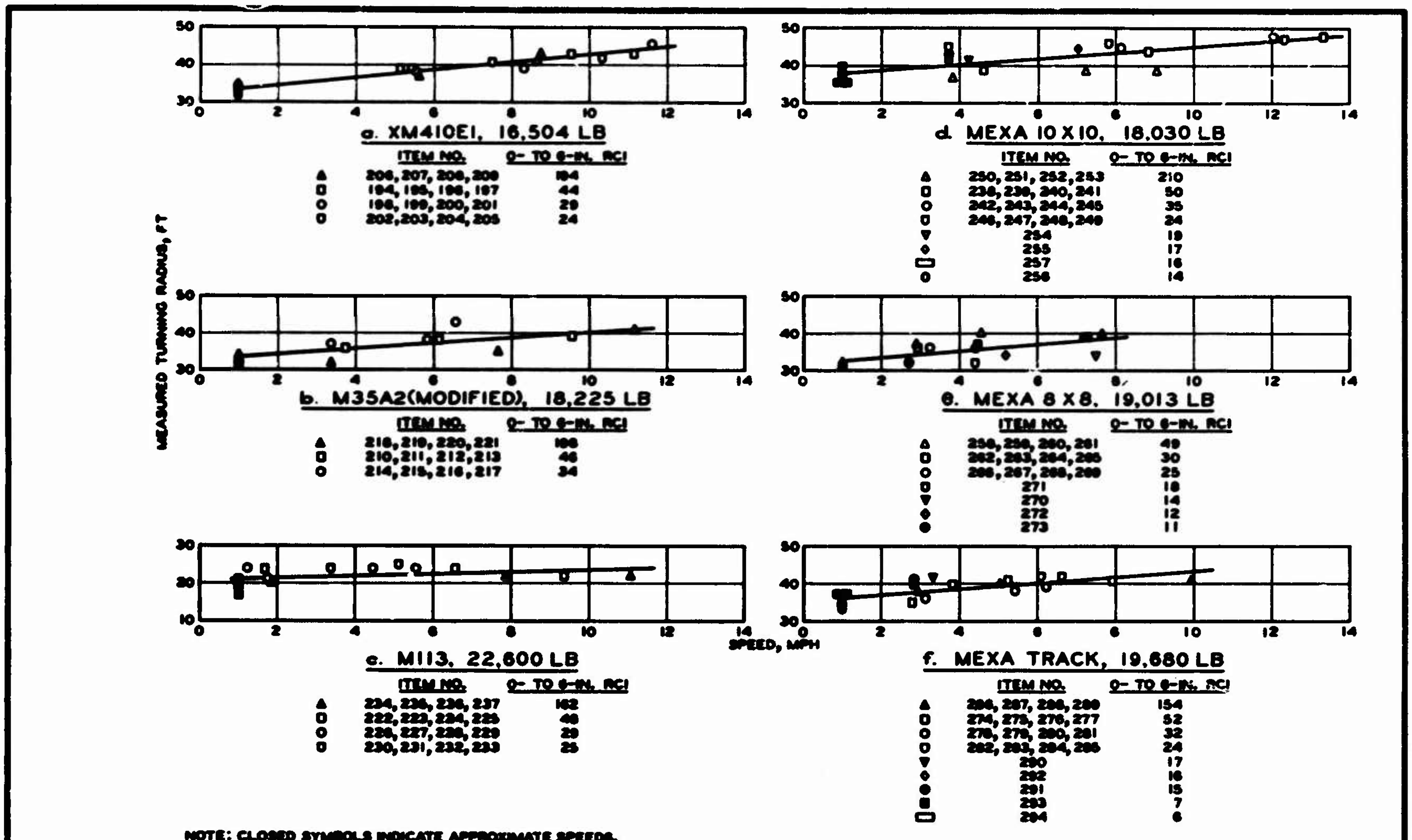


c. MEXA TRACK, 19,680 LB

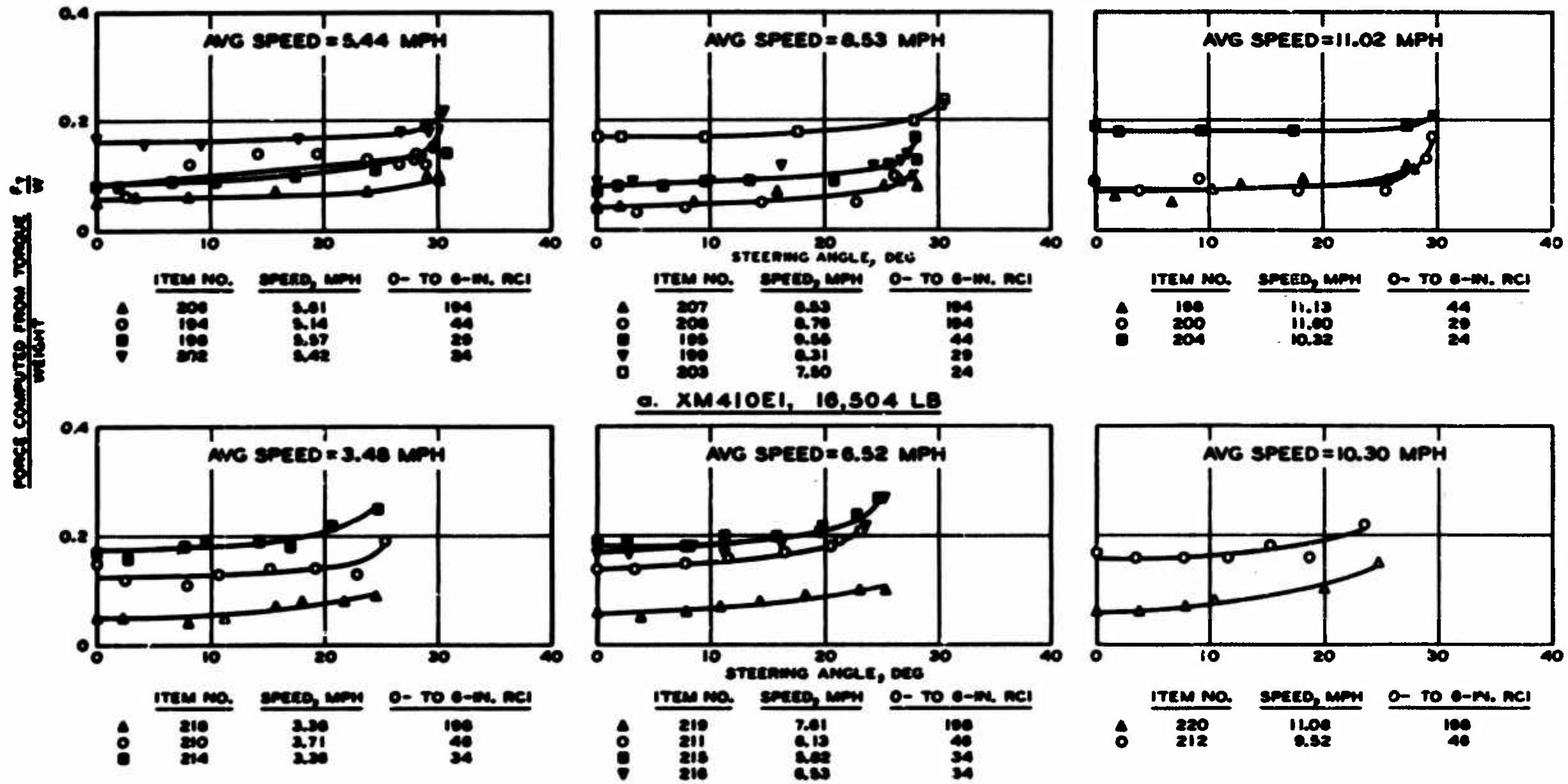
SYMBOL	ITEM NO.	0- TO 6-IN. RCI	RANGE AND TRANSMISSION
○	179	49	H-1, H-2
△	180	31	H-1, H-2
□	181	24	H-1, H-2
▽	182	183	H-1, H-2
●	183	10	L-1, L-2
▲	184	6	L-1, L-2
■	185	PAVEMENT	H-1, H-2

VEHICLE SPEED VS TIME
MEXA VEHICLES


VEHICLE SPEED VS
0- TO 6-IN. RCI
a. XM410E1, 16,504 LB
b. M35A2 (MODIFIED), 16,225 LB
c. M113, 22,600 LB
d. MEXA 10X10, 18,030 LB
e. MEXA 8X8, 19,013 LB
f. MEXA TRACK, 19,680 LB
SPEED, MPH
0- TO 6-IN. RCI
PAVEMENT
LEGEND
CARSON SINK TESTS
FOUR MILE FLAT TESTS
PAVEMENT TESTS
PAVEMENT TEST AT HIGHWAY TIRE PRESSURE (XM410E1, 35PSI; M35A2(MODIFIED), 70PSI)
VCI1c-1



TURNING RADIUS VS SPEED



a. XM410E1, 16,504 LB

b. M35A2 (MODIFIED), 18,225 LB

FORCE COMPUTED FROM TORQUE / WEIGHT VS STEERING ANGLE

MILITARY VEHICLES

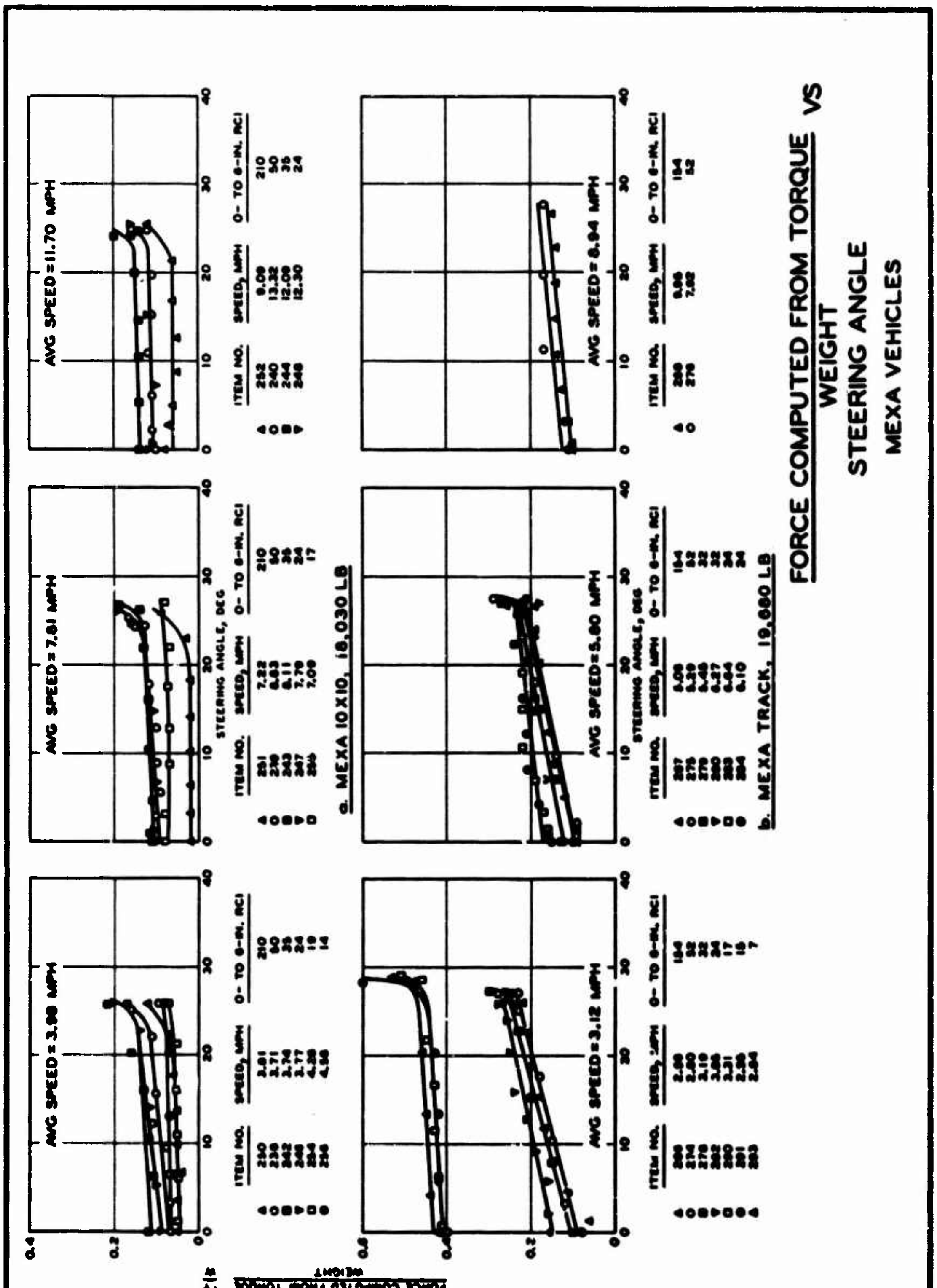
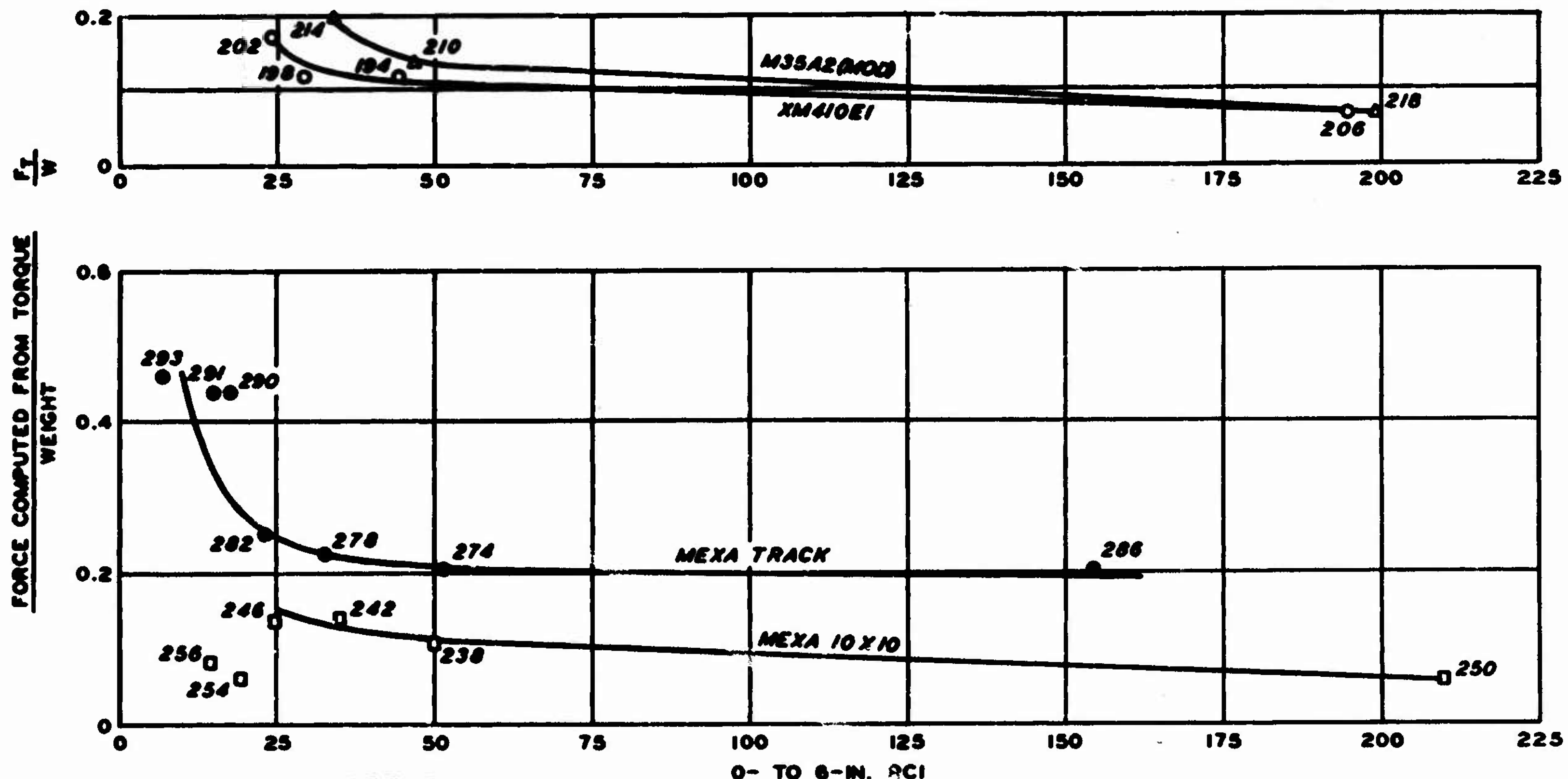

FORCE COMPUTED FROM TORQUE / WEIGHT VS STEERING ANGLE
MEXA VEHICLES
a. MEXA 10X10, 18,030 LB
b. MEXA TRACK, 19,680 LB
AVG SPEED = 3.98 MPH
AVG SPEED = 7.81 MPH
AVG SPEED = 11.70 MPH
AVG SPEED = 3.12 MPH
AVG SPEED = 5.80 MPH
AVG SPEED = 6.94 MPH
STEERING ANGLE, DEG
FORCE COMPUTED FROM TORQUE / WEIGHT
ITEM NO.
SPEED, MPH
0- TO 6-IN. RCI

PLATE 12

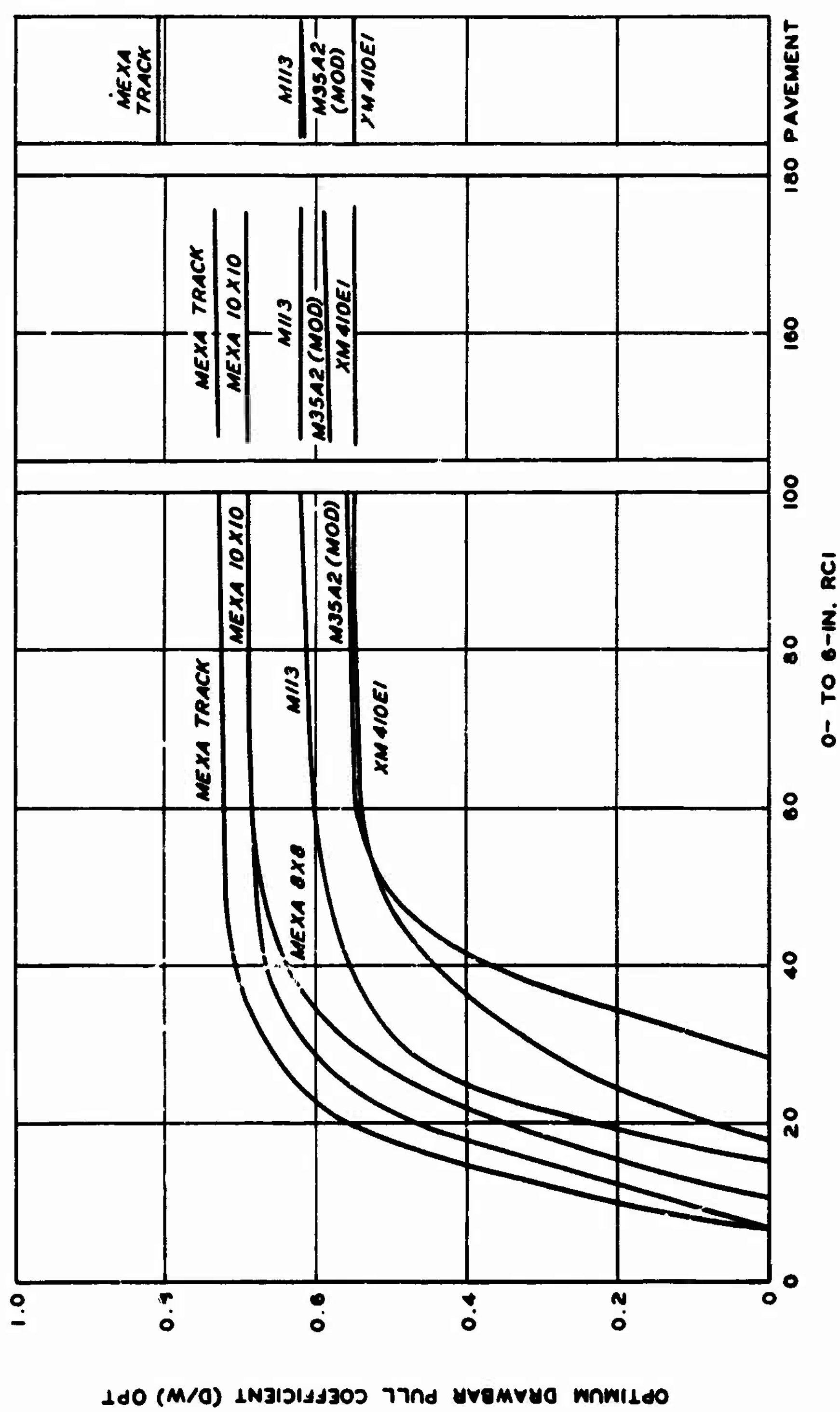


LEGEND

	VEHICLE	STEERING ANGLE, DEG	AVG SPEED, MPH
O	XM410E1	24.0	5.44
Δ	M35A2 (MOD)	19.5	3.48
□	MEXA 10X10	20.9	3.98
●	MEXA TRACK	22.2	3.12

NOTE: NUMBERS NEAR PLOTTED POINTS ARE ITEM NUMBERS.

FORCE COMPUTED FROM TORQUE / WEIGHT VS 0- TO 6-IN. RCI



COMPARISON OF
OPTIMUM DRAWBAR PULL
COEFFICIENT VS
0- TO 6-IN. RCI

PLATE 14

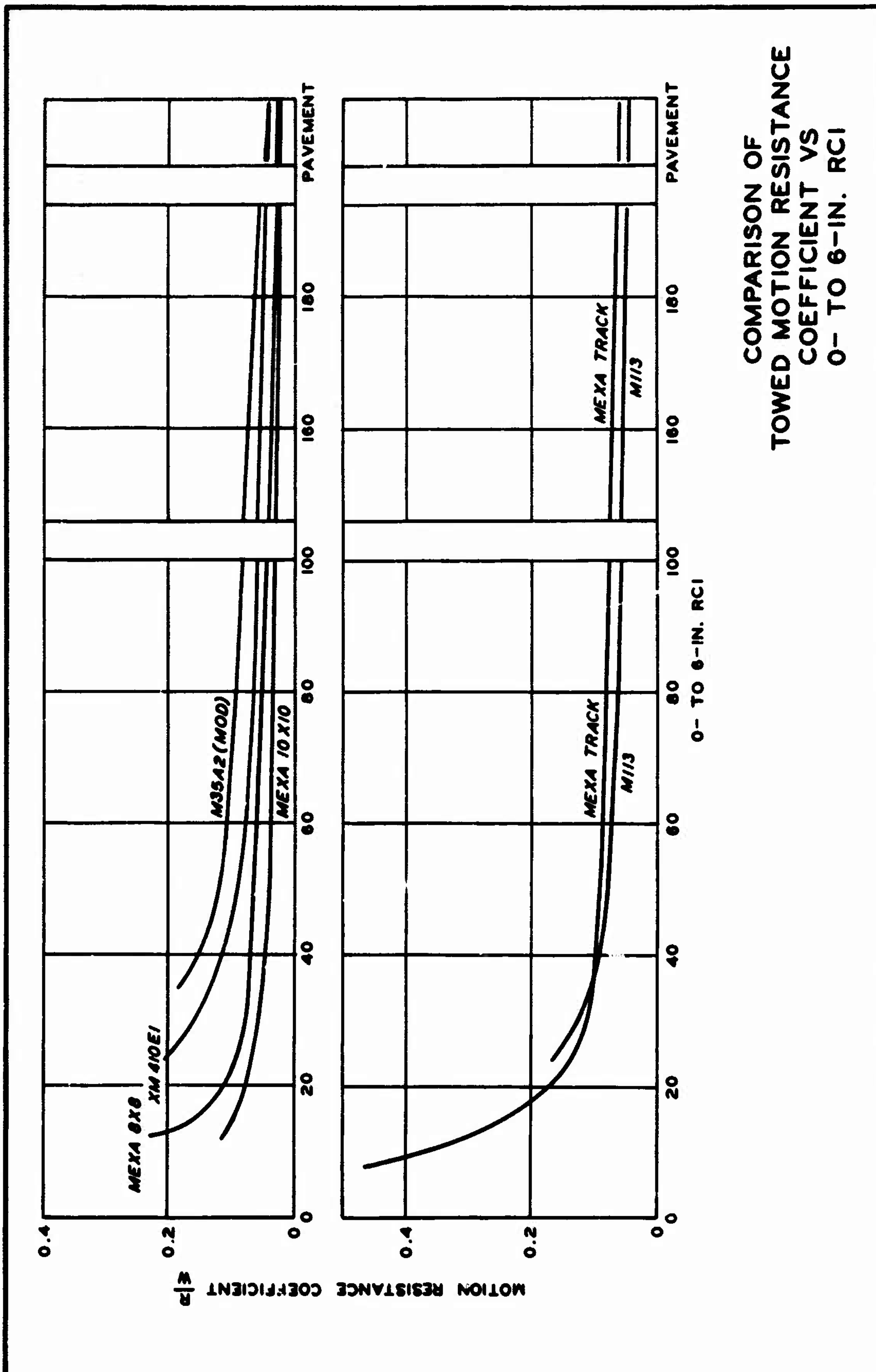
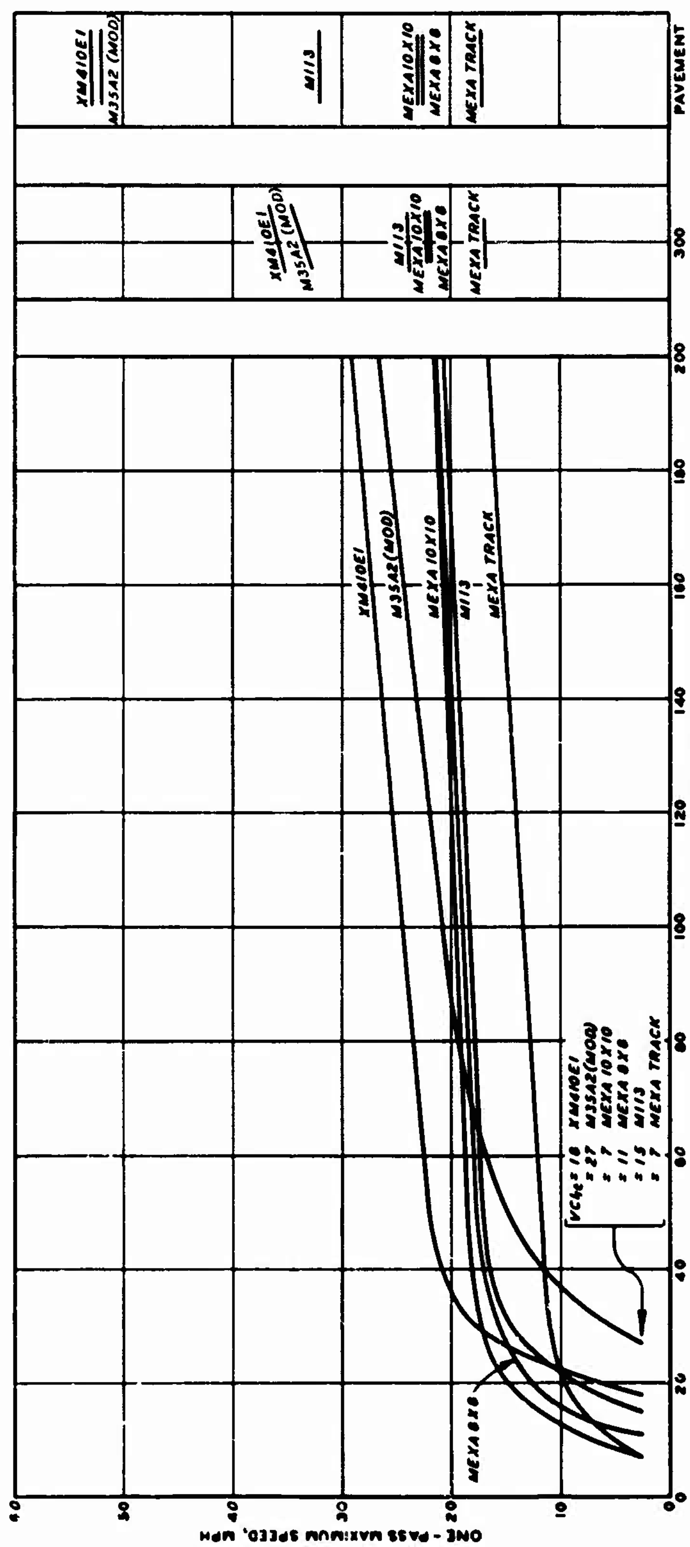
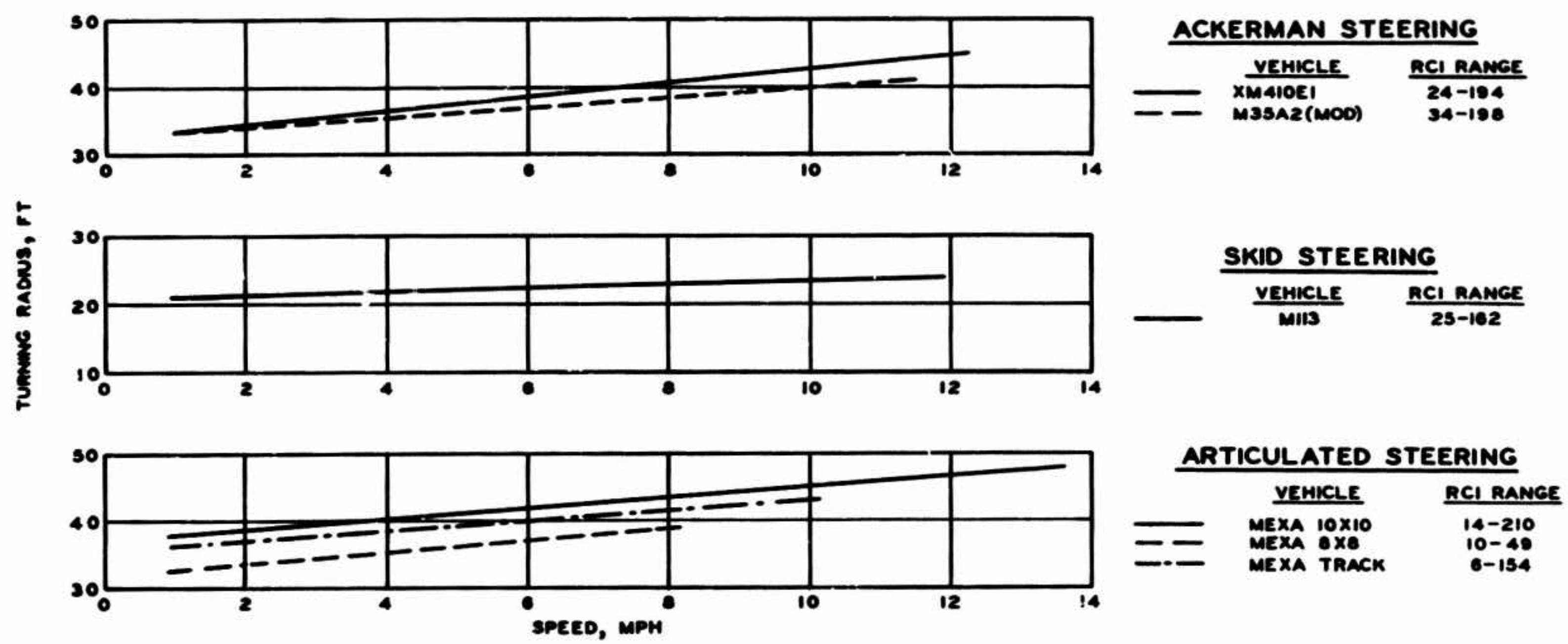

COMPARISON OF
TOWED MOTION RESISTANCE
COEFFICIENT VS
0- TO 6-IN. RCI
MOTION RESISTANCE COEFFICIENT $\frac{M}{R}$
0- TO 6-IN. RCI
PAVEMENT
MEXA 8X8
XM 410E1
M35A2 (MOD)
MEXA 10 X 10
MEXA TRACK
M113
0
0.2
0.4
20
40
60
80
100
160
180

PLATE 15



COMPARISON OF
VEHICLE SPEED VS
0– TO 6–IN. RCI

PLATE 16



TURNING RADIUS
VS SPEED AT
SELECTED SOIL STRENGTHS

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13. ABSTRACT

In the concept phase of Mobility Exercise A (MEXA) the principal purpose was to design vehicles capable of operating in remote areas of the world where extremely soft soils predominate, and to develop a program of tests for evaluating these vehicles in soft soils. As a result of the MEXA concept phase, two 2-1/2-ton wheeled and one 2-1/2-ton tracked vehicles were designed. The designs of the vehicle characteristics were in part derived from three existing systems that provide for predicting vehicle performance relative to soil strength. These systems were the U. S. Army Engineer Waterways Experiment Station (WES) soil trafficability system, the WES mobility numeric system, and the Land Locomotion Laboratory soil value system. After the MEXA vehicles were fabricated, a field test program was designed and conducted. A total of 328 tests were conducted on level clay soils, at two sites near Vicksburg, Miss., and at eight sites near Fallon, Nev. The purpose of the test program was to evaluate the performance of the three MEXA vehicles (MEXA 10x10, MEXA 8x8, and MEXA track) and three military vehicles (XM410E1, M35A2 (mod), and M113) on a range of soil strengths. Further purposes of this study were to compare the performances of the three MEXA vehicles with those of the three military vehicles and to compare the measured and the predicted performances of the vehicles, using the three prediction systems from which the MEXA vehicles were designed. The measured and predicted performance comparisons are presented in Appendixes A, B, and C, Volume II. Test results indicate that the MEXA vehicles do what they were designed to do, i.e. perform better on soft soils than military vehicles. However, on firm soil and on pavement, performance is not as good as that of the military vehicles. The MEXA vehicles were superior to the military vehicles in terms of soil strength required for one pass and 50 passes (VCI_{1} and VCI_{50}).

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